THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LVI. No. 1441.] LONDON, DECEMBER 23, 1890. [42ND YEAR. Price 6d.

WOLSTON'S Paste and Ready Mixed for Use.
Guaranteed Free from Adulteration. **TORBAY PAINTS.**
FOR GASHOLDERS, &c., &c.
The Original "Torbay Paints"
As supplied during the present and many preceding years to the LONDON GASLIGHT & COKE COMPANY.
Special Quotations to Gas Companies.
TORBAY & DART PAINT Co., Ld.,
23, Gt. George St., Westminster, S.W.
Works: DARTMOUTH, DEVON.

— ESTABLISHED 1830. —
PARKER & LESTER,
Manufacturers & Contractors.
THE ONLY MAKERS OF
PATENT ANTIMONY PAINT,
Parker's Imperial Black Varnish,
Oxide Paints, Oils, and General Stores for Gas and Water Works.
WORKS:
ORMSIDE STREET, OLD KENT ROAD, LONDON.
Ashmore, Benson, Pease, & Co., Ld.,
STOCKTON-ON-TEES,
Manufacturing Gas Engineers.
See Advertisement, p. 820.

CEMENT
EARLE'S
BEST
Portland Cement
MANUFACTURED BY
GEO. & THOS. EARLE,
HULL.
Office: 7, PIER STREET.
Works: WILMINGTON.
STOREAGE CAPACITY 10,000 Tons.
ESTABLISHED 1811—OVER THREE QUARTERS OF A CENTURY.
Telegraphic Address: "CEMENT HULL."

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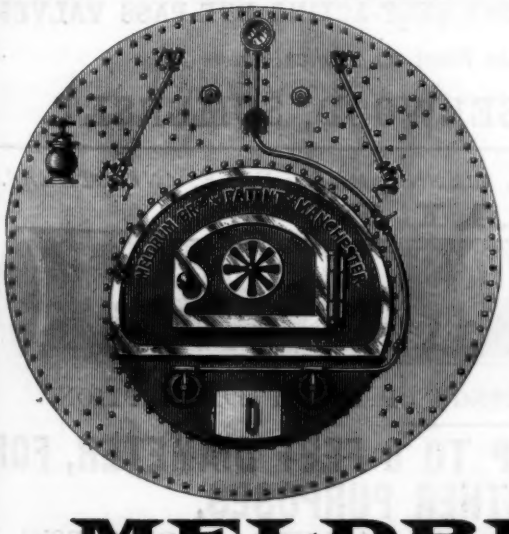
"ABYSSINIAN" & ARTESIAN TUBE WELLS,
FOR TOWN WATER-WORKS AND OTHER SUPPLIES.
The following Town Water-Works Supplies have been obtained by this System, viz. :—Abbott's Langley, Aldershot, Alnwick, Cirencester, Hertford, Lechlade, St. Albans, Shrewsbury, Skegness, Southampton, Stony Stratford, Swansea, Wallingford, Watford, West Worthing, Wimborne, &c.
LE GRAND & SUTCLIFF,
HYDRAULIC ENGINEERS, 100, BUNHILL ROW, LONDON, E.C.

SELF-CONTAINED DUST FUEL FURNACE.



OVER 200 WORKING,
RAISING STEAM WITH COKE DUST, COAL DUST, TOWNS' REFUSE, AND OTHER WASTE FUEL.
GLASGOW: F. J. ROWAN, 121, West Regent Street.
LONDON: WM. BOBY, 16, Union Court, Old Broad Street.
GERMANY, AUSTRIA, BELGIUM, SWITZERLAND, ITALY } ALFRED WENNER, Manchester.
MELDRUM BROS.,
26, HALF STREET, MANCHESTER.

DANIEL HOWARD,

(Successor to the late BENJ. WHITEHOUSE),

GASHOLDER & BOILER WORKS,

WEST BROMWICH, NEAR BIRMINGHAM

(ESTABLISHED 1765).

MANUFACTURER OF TELESCOPIC AND SINGLE GASHOLDERS,

WROUGHT AND CAST IRON TANKS FOR DITTO,

PURIFIERS, CONDENSERS, SCRUBBERS, HYDRAULIC MAINS, and all kinds of GAS APPARATUS,

Wrought-Iron Roofs, Bridges, Girders, &c.,

Steam, Hot Water, and Range Boilers, Tanks, Cisterns, Boats, and all kinds of Wrought-Iron Work.

DRAWINGS, SPECIFICATIONS, AND ESTIMATES SUPPLIED ON APPLICATION.

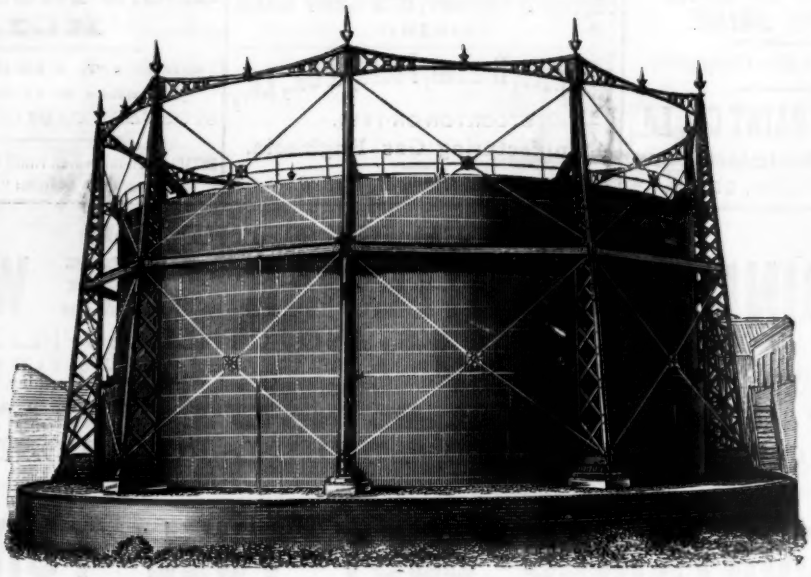
TELEGRAPHIC ADDRESS: "COCKEY'S FROME."

EDWARD COCKEY & SONS, Ld.,

ESTABLISHED OVER HALF A CENTURY.

Gas Engineers, Ironfounders, & Contractors,

Manufacturers of *GASHOLDERS and TANKS, BOILERS and ENGINES, ROOFS, EXHAUSTERS, BREEZE SCREENS, CHARGING and COKE BARROWS.*



Manufacturers of *PATENT WASHERS, PATENT VALVES for PURIFIERS, &c., GOVERNORS, LAMP COLUMNS, Weighbridges, COKE BREAKERS.*

SOLE MAKERS OF COCKEY AND SMITH'S PATENT SELF-ACTING BYE-PASS VALVES.

Estimates for any description of Gas Plant on application.

THE IRON-WORKS, FROME SELWOOD, SOMERSET.

HIGHEST AWARDS—LONDON, PARIS, COLOGNE, VIENNA, MELBOURNE, AND OTHERS.

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MANUFACTURERS OF TUBES AND FITTINGS OF EVERY DESCRIPTION.

WROUGHT-IRON OR STEEL MAINS UP TO 6 FEET DIAMETER, FOR GAS, WATER, OIL, OR OTHER PURPOSES.

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Established 1822

— SPRING HILL, BIRMINGHAM, —

MANUFACTURERS OF

GAS APPARATUS

Of every description.

GASHOLDERS

AND TANKS.

RETORTS, PURIFIERS, VALVES, SCRUBBERS, CONDENSERS, ETC., ETC

All of the most approved designs.

BOILERS, ENGINES, PUMPS.

Beale's and other Exhausters.

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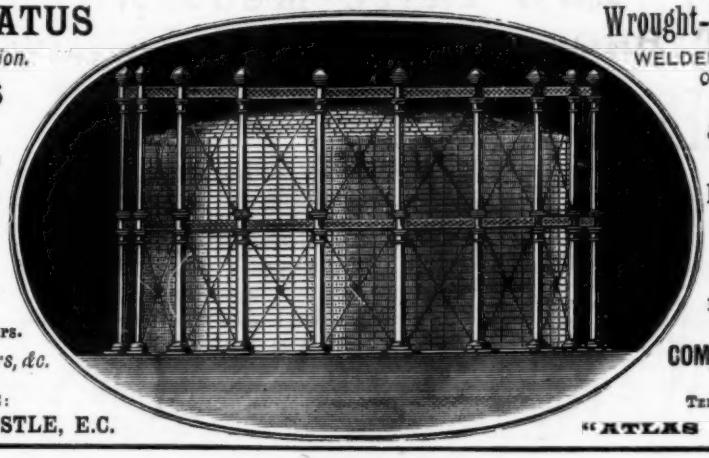

Wrought-Iron Ascension-Pipes

WELDED AND RIVETTED PIPES OF ALL KINDS OVER 8 INCHES DIA.

SOMERVILLE'S PATENT

RETORT MOUTHPIECES

AND

SELF-SEALING LIDS.

No luting required.

Drawings, Specifications, and Estimates prepared for

COMPLETE GAS PLANTS

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MANUFACTURERS OF EVERY DESCRIPTION OF

IRON OR STEEL LAP-WELDED OR BUTT-WELDED TUBES

FOR ANY PURPOSE.

NEWTON, CHAMBERS, & CO., LIMITED,

THORNCLIFFE IRON-WORKS, near SHEFFIELD,

MANUFACTURERS OF

SLIDE VALVES,

WITH RACK & PINION,

OR

Internal or External SCREWS, of all Sizes.

GASHOLDERS,

AND

Gasholder Tanks.

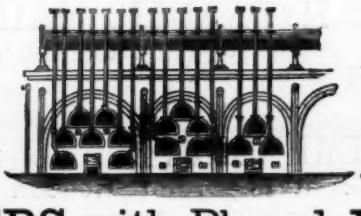
CAST-IRON RETORTS,

RETORT-BED FITTINGS,

And Retort-House Appliances

of every description.

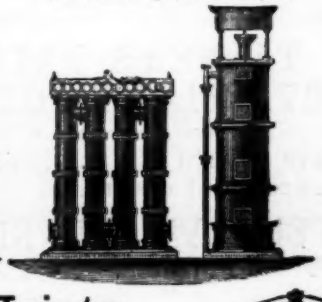
Iron Roofs, Columns, Girders, Floor Plates and Tools, &c.



WROUGHT AND CAST IRON

CONDENSERS, SCRUBBERS, & WASHERS,

TAR AND LIQUOR PUMPS, &c.



PATENT

CENTRE VALVES

for working Purifiers.

Also Bye-Pass & Stop Valves.

PURIFIERS with Planed Joints,

HAND and HYDRAULIC LIFTING GEAR, CAST-IRON MAINS and SPECIALS,

WOOD GRIDS.

CAST AND WROUGHT IRON TANKS AND CISTERNS.

DESIGNS, SPECIFICATIONS, AND ESTIMATES FREE.

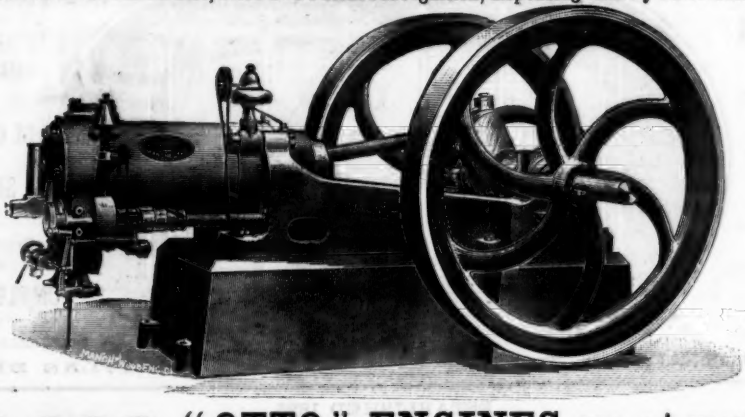
Pig Iron (*Special Quality*) for ENGINE CYLINDERS, &c.

GAS COAL FAMOUS FOR ITS UNRIVALLED EXCELLENCE.

CROSSLEY'S "OTTO" GAS-ENGINE.

100 Prize Medals.

New 14-H.P. Nominal Size, fitted with Patent Tube Ignition, dispensing entirely with Plates.



MADE in SIZES
2-Man to 100-HP.

GAS-ENGINES
COMBINED
WITH
PUMPS
FOR
TOWNS SUPPLY,
SEWAGE, &c., &c.

GAS-ENGINES
COMBINED
WITH
AIR COMPRESSORS
FOR THE
SHONE SEWAGE
SYSTEM, LUCIGEN
LIGHT, &c.

MADE in SIZES
2-Man to 100-HP.

VERTICAL
AND
HORIZONTAL
TYPES.

ENGINES
COMBINED
WITH
HOISTS, PUMPS,
DYNAMOS &c. &c.

Largely used for
EXHAUSTING,
PUMPING,
COKE CRUSHING,
ELECTRIC LIGHTING,
&c., &c.

Over **31,000** "OTTO" ENGINES are at work.

CROSSLEY BROS., LTD., OPENSHAW, MANCHESTER,

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LIVERPOOL,
GLASGOW,
NEWCASTLE,
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HARRIS & PEARSON,

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MANUFACTURERS OF

FIRE-CLAY GAS-RETORTS, FIRE-BRICKS, LUMPS, & TILES of Every Description.

GLAZED BRICKS AND PORCELAIN BATHS.

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Offices: 16, Great George St., Westminster. Works: Millwall, London.

Apparatus of every description for Gas and Water Works.

MORRIS & CUTLER'S PATENT "PERFECT" CONDENSER.
The most efficient condensing apparatus obtainable. In use at 60 Works, and now in course of erection at Melbourne, Hornsey, Winchester, Ware, &c.

LIVESEY AND TANNER'S PATENT DIFFERENTIAL TAR AND LIQUOR OVERFLOWS FOR HYDRAULIC MAINS.
A neat and effective apparatus to remove Tar from the Hydraulic Main and ensure a light Liquor Seal.
300 Sets in successful operation.

CUTLER'S PATENT WATER-SEAL VALVES, especially suitable for large Mains at Purifiers. In use at important London and Provincial Works.

CUTLER'S PATENT FREEZING PREVENTER AND CIRCULATOR for cups of Gasholders. Now being fitted to Holders at the Works of The Gaslight and Coke Company, and at the Imperial Continental Works at Hanover and Vienna.

Further particulars of these and other useful specialities will be supplied on application to the Westminster Office.

CARLESS, CAPEL, & LEONARD,

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NAPHTHA & GASOLINE DISTILLERS & PETROLEUM IMPORTERS,

SPECIALLY PREPARE GASOLINE OF ANY SPECIFIC GRAVITY BEST ADAPTED FOR CARBURETTING GAS; ALSO PETROLEUM ETHERS OF CONSTANT BOILING POINTS.

Prices and Samples may be had upon application.

JOSEPH CLIFF & SONS,

INCORPORATED IN THE LEEDS FIRE-CLAY COMPANY, Ltd.,

WORTLEY, LEEDS.

LONDON Offices & Depôts:
Baltic Wharf, Waterloo Bridge.

WHARVES NOS. 2 & 4, INSIDE G.N. GOODS YARD, KING'S CROSS, N.

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MACHINE-MADE RETORTS

Have been made in large quantities for the last twelve years; and during the whole of that time, have been in regular use at most of the largest Gas-Works in the Kingdom. They possess the excellent quality of remaining as near stationary as possible under the varying conditions of their work—a quality which will be appreciated by all Gas Engineers and Managers. The generally expressed opinion is that these Retorts are the very best that are made.

RETORTS CAREFULLY PACKED FOR EXPORT.

Fire-Bricks, Lumps, Tiles, &c., &c., of every description suitable for Gas-Works.

ESTABLISHED MORE THAN A QUARTER OF A CENTURY

WORKS HUNSLET, LEEDS

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CLAYTON SON & CO. LTD.

MAKE A SPECIALTY OF GASHOLDERS

AND MAKERS OF GAS PLANT OF EVERY DESCRIPTION.

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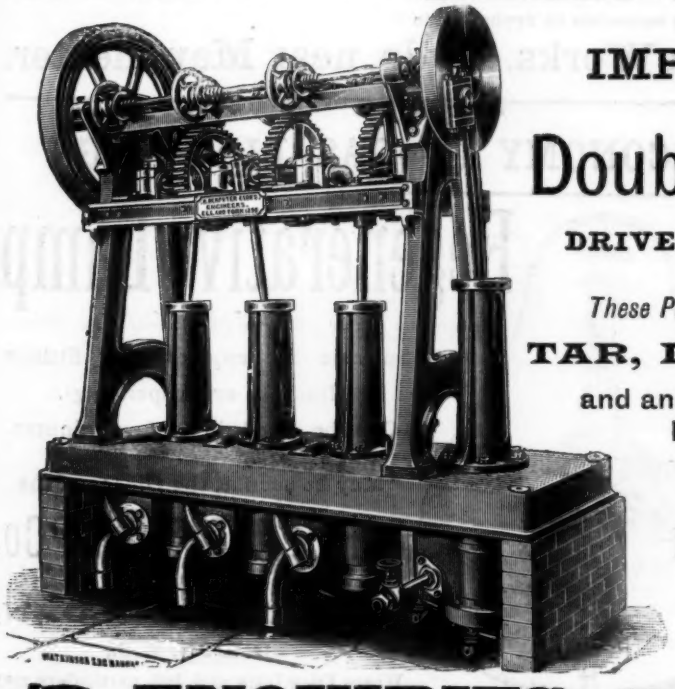
R. DEMPSTER & SONS, Ltd.,

GAS, CHEMICAL, & HYDRAULIC ENGINEERS & CONTRACTORS,

ESTABLISHED — **ELLAND.** — 1855.



IMPROVED BATTERY OF THREE Double-Acting Pumps

DRIVEN BY ONE STEAM-ENGINE.

These Pumps are fitted with Valves for pumping

TAR, LIQUOR, and WATER,

and an arrangement by which any of these Liquids may be pumped together or separately.

BEST MATERIALS AND WORKMANSHIP, AND EFFICIENCY GUARANTEED.

ENQUIRIES SOLICITED.

JOHN HALL & CO.,

STOURBRIDGE,

MANUFACTURERS OF FIRE-BRICKS, LUMPS, TILES,

AND EVERY DESCRIPTION OF FIRE-CLAY GOODS.

RETORTS CAREFULLY PACKED FOR SHIPMENT.

A STOCK OF DIFFERENT SHAPES ON HAND.

GAS AND WATER PIPES

AND

CASTINGS OF EVERY DESCRIPTION.

MANUFACTURED BY THE

CLAY CROSS COMPANY,

CHESTERFIELD.

TRADE	TELEGRAMS:	LONDON AGENTS:
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MARK.	CLAY CROSS.	130, GT. SUFFOLK ST., S.E.

SULPHATE OF AMMONIA.

By Her Majesty's Royal Letters Patent.

DR. FELDMANN'S APPARATUS

The most successful and approved Apparatus known up to the present time.

FOR REFERENCES, PARTICULARS, TESTIMONIALS, AND PRICES APPLY TO THE

Sole Agents and Manufacturers,

GODDARD, MASSEY, & WARNER,

ENGINEERS,

NOTTINGHAM.

The Apparatus has been supplied to the following Firms—

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CHANCE BROTHERS, OLDBURY (4 Apparatus).
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NETHAM CHEMICAL CO., Limited, BRISTOL.
ANIMAL CHARCOAL CO., Limited, SHADWELL.
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ILKESTON.	BURY.	CHORLEY.
WIDNES	BRIGHOUSE.	WHITEHAVEN.
HALIFAX.	MARKET HARBRO'.	CHESTER.
ALTRINCHAM.	PRESCOT.	SOUTH SHIELDS.
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ST. ALBANS.	LEICESTER.	IPSWICH.
DUKINFIELD.	DARWEN.	BOURNEMOUTH.
NORTHWICH.	NELSON.	SALFORD.
HUDDERSFIELD.	ORMSKIRK.	LUTON.
		HAMPTON COURT.

RUSCOE'S PATENT MACHINE

FOR DRILLING AND TAPPING WATER-MAINS AND GAS-MAINS UNDER PRESSURE.

Patent Saddle Back and Drilling Apparatus, whereby Gas and Water Mains can have 2-in., 3-in., 4-in., 5-in., and 6-in. Branches put on without loss of Water or Gas.

Sole Maker of HELPS' PATENT PIPE EXTRACTOR.

Prices and Particulars on Application to

JOHN RUSCOE, Albion Works, Hyde, near Manchester.

SIXTY PER CENT. ECONOMY IN GAS LIGHTING.

The Schülke Regenerative Lamp

FOR

DOMESTIC AND EXTERNAL LIGHTING.

The only Regenerative Lamp employing the Common Flat-Flame Burners.

Lamps giving 20-Candle power consume less than four feet of Gas per hour.

PURE WHITE & PERFECTLY STEADY LIGHT,

NOT AFFECTED BY DRAUGHTS.

Suitable for any existing fittings (Brackets or Suspending).

Can be fixed in a few minutes.

May be seen at the Offices of the

SCHÜLKE GAS-LAMP Co.

LIMITED,

20, HIGH HOLBORN,

LONDON, W.C.,

Where Price Lists and full particulars may be obtained.

KIRKHAM, HULETT, & CHANDLER'S, LTD.,

[SIDNEY HERSE', Managing Director.] **NEW PATENT** [J. CHANDLER, Engineer.]

"STANDARD" WASHER.

EXTRACTS THE WHOLE OF THE AMMONIA

Also a Large Proportion of H_2S and CO_2 from Gas.

The following List comprises the orders received for PATENT "STANDARD" WASHERS constructed according to the Company's latest patent, and Renewals effected by the application of same to old pattern Machines.

NEW PATENT "STANDARD" WASHERS.

	Capacity, cub. ft. per 24 hours.
THE GASLIGHT AND COKE COMPANY—	
Kensal Green	3,000,000
,,	3,000,000
West Ham	3,000,000
Liverpool	3,000,000
Rochdale	3,000,000
Manchester	2,500,000
Glasgow	2,500,000
,,	2,500.000
Leicester	2,250,000
Melbourne	1,500,000
Charlottenburg	1,500,000
Derby	1,500,000
,,	1,000,000
Cambridge	1,000,000
Nice	875,000
Barcelona	875,000
Magdeburg	750,000
Valparaiso	600,000
Halle	600,000
Barry and Cadoxton	500,000
Workington	500,000
Lowestoft	500,000
Erfurt	400,000
St. Chamond	350,000
Atlas Steel Works, Sheffield	250,000
Lille	250,000
Rawmarsh	200,000
Vercelli	200,000
Hitchin	150,000

RENEWALS.

THE GASLIGHT AND COKE COMPANY—	
Beckton	2,500,000
,,	1,250,000
Nine Elms (in part)	3,000,000
Shoreditch ,,	2,500,000
Pimlico ,,	2,000,000
Bromley ,,	2,000,000
SOUTH METROPOLITAN GAS COMPANY—	
Vauxhall (in part)	3,000,000
Birmingham ,,	5,000,000
Croydon	1,500 000
Edinburgh	1,500,000
West Ham	1,500,000
Nottingham	1,500,000
Melbourne	1,500,000
,,	1,500,000
Maidstone	1,000,000
Kingston-on-Hull	400,000
Harrow	250,000
Buxton	250,000

For Testimonial from the Chief Engineer of The Gaslight and Coke Company, see last and next week's issue of the "Journal."

Palace Chambers, Bridge Street, Westminster, S.W.

R. & J. DEMPSTER,

GAS PLANT WORKS, NEWTON HEATH, MANCHESTER,

MAKERS AND ERECTORS OF

PATENT COLUMNLESS GASHOLDERS,

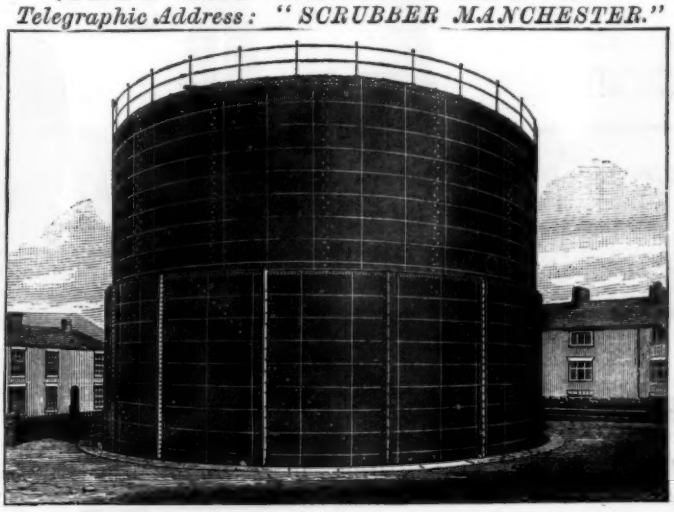
(GADD AND MASON'S PATENT).

Telegraphic Address: "SCRUBBER MANCHESTER."

TOTAL WEIGHT REDUCED from 30 per cent. to 50 per cent.

TRANSPORT AND ERECTION REDUCED to the same extent; and in cases where gasholders are shipped abroad to places difficult of access, this represents a very large amount of money.

TANK CONSTRUCTION SIMPLIFIED. The Tank wall (of whatever construction) is a regular cylinder. There are no piers needed, and all expensive foundation stones for the base of columns or standards are dispensed with.



Two-Lift Gasholder erected at the Gas-Works, Northwich, which has been in continuous work since Jan. 3, 1890, and has been subjected to most severe tests from heavy gales, with perfectly satisfactory results.

COST OF PAINTING SAVED for the Columns and Girders.

TILTING UTTERLY IMPOSSIBLE; And as there are fewer parts, there is less liability for the Gasholder to get out of order in working.

STABILITY UNDER WIND PRESSURE of a Gasholder constructed upon this system is at least equal to, and from experiments and calculations made is far in excess of, that of a Holder of the same dimensions guided by the elaborate guide framing at present in use.

The removal of heavy guide carriages and rollers from the top curbs considerably lowers the centre of gravity of the structure, and dispenses with the extra strength of sheeting necessary to carry these at the points where they are attached to the gasholder.

The plan adapts itself to telescoping to any reasonable extent, and enables very shallow holders or lifts to be employed with perfect stability.

For further particulars and estimates, apply to the above, or to

THE PATENT GASHOLDER SYNDICATE, 504, STOCKPORT ROAD, MANCHESTER.

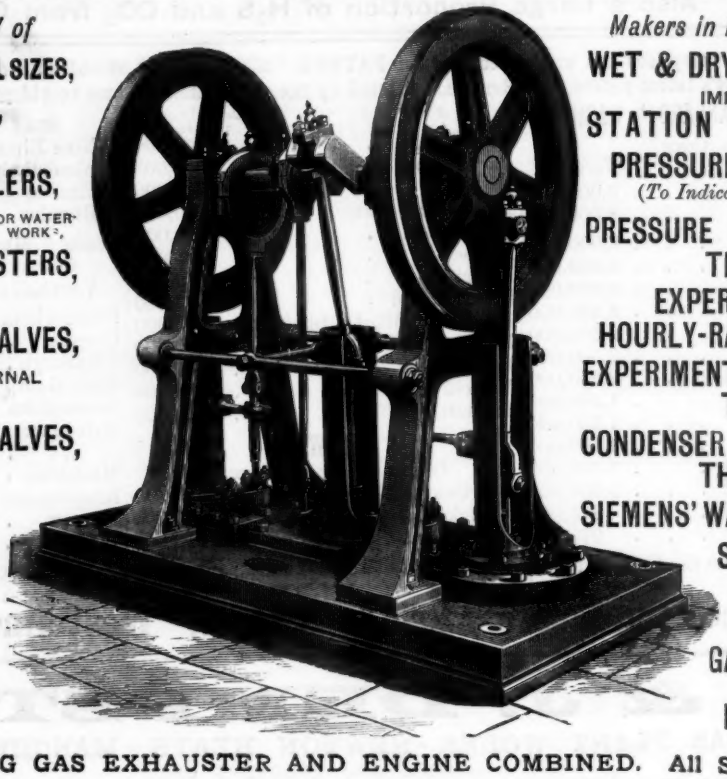
R. LAIDLAW & SON,

GAS AND WATER ENGINEERS.

Manufacturers of **GAS APPARATUS** of every Description.

Makers in GLASGOW of

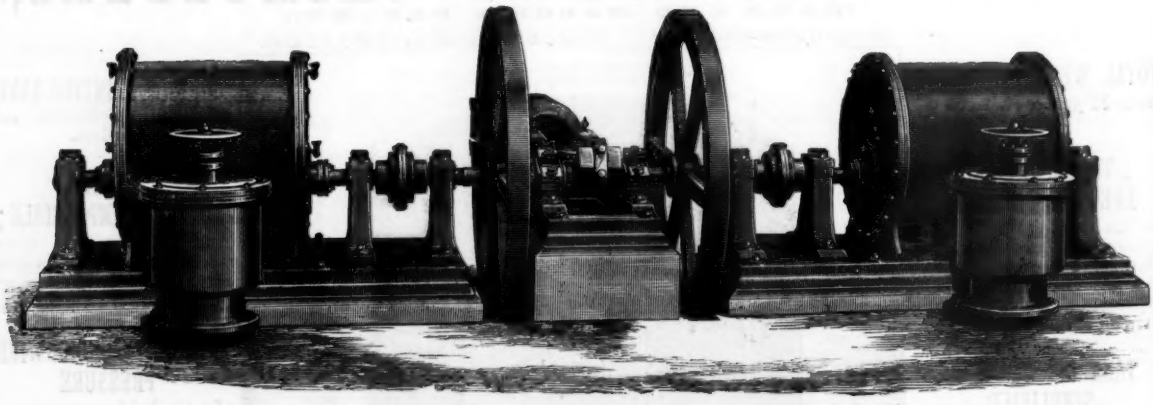
CAST-IRON PIPES, ALL SIZES,
LAMP PILLARS,
STEAM-ENGINES AND BOILERS,
PUMPING ENGINES FOR WATER-WORKS,
BEALE'S GAS EXHAUSTERS,
DOUBLE-FACED SLUICE VALVES,
INTERNAL AND EXTERNAL RACK OR SCREW SLIDE VALVES,
CAST-IRON COLUMNS,
BEAMS, GIRDERS, AND WATER-TANKS,
WROUGHT-IRON TUBES, FITTINGS, &c.



Makers in EDINBURGH of

WET & DRY GAS-METERS,
IMPROVED STATION GOVERNORS,
PRESSURE REGISTERS *(To Indicate New Time)*,
PRESSURE GAUGES,
TEST HOLDERS,
EXPERIMENTAL HOURLY-RATE METERS,
EXPERIMENTAL TEST METERS,
CONDENSER THERMOMETERS,
SIEMENS' WATER-METERS,
STREET LANTERNS,
And all Kinds of GAS APPARATUS AND FITTINGS, &c.

PUMPING GAS EXHAUSTER AND ENGINE COMBINED. All Sizes.



BEALE'S GAS EXHAUSTERS AND ENGINE COMBINED. All Sizes.

Prices, with full Particulars, will be given on application.

Two Gold Medals, One Silver Medal, One Bronze Medal, and Two Honourable Mentions,
INTERNATIONAL EXHIBITION, EDINBURGH, 1886.

ALLIANCE FOUNDRY, **GLASGOW.** | SIMON SQUARE WORKS, **EDINBURGH.** | 6, LITTLE BUSH LANE, **LONDON, E.C.**

TANGYES LIMITED,

CORNWALL WORKS, BIRMINGHAM.

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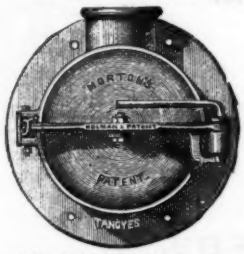
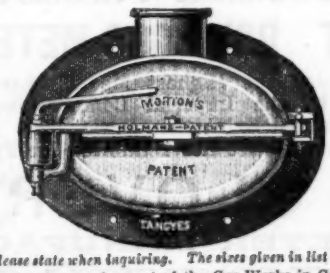
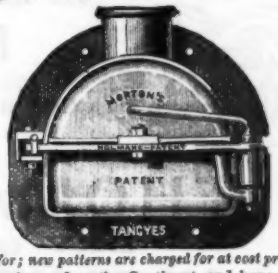
NEWCASTLE-ON-TYNE ST. NICHOLAS BUILDINGS | GLASGOW . . . . . ARGYLE STREET

Sole Makers of **MORTON'S** Patent Self-Sealing **RETORT-LIDS,**

With Anti-Friction CATCHES, and Self-Sustaining CROSS-BARS.







Price of Mouthpieces depends on number required, which please state when inquiring. The sizes given in list we have patterns for; new patterns are charged for at cost price.

These Patent Retort Lids and Fastenings are in extensive use in most of the Gas-Works in Great Britain, America, and on the Continent, and have almost entirely displaced the older method of sealing by a luting of lime or other material. The Lids are made in three forms, D, oval, and round (as shown above), in each of which we have a very extensive variety of patterns, from which Gas Engineers contemplating the adoption of these lids are recommended to make their selection, in order to avoid cost of pattern making, delays, &c., &c.

Mouthpieces with Circular Lids for Oval Retorts.

Pattern No.	Diam. Mouth.	Internal Dimensions of Retort.	Length of Mouthpiece.	PRICE, Lid and Fittings without Mouthpiece.
13658	14 ins.	14 × 12 ins.	15 ins.	£0 19 0
4356	14 „	18½ „ 12 „	12½ „	0 19 0
6851	15 „	15 „ 14 „	13 „	1 0 0
3629	15 „	18½ „ 13½ „	14 „	1 0 0
3580	15 „	21 „ 15 „	15 „	1 0 0
6264	16 „	18½ „ 15½ „	15½ „	1 1 0
5210	16 „	20 „ 14 „	15 „	1 1 0
6263	16 „	24 „ 16 „	13½ „	1 1 0
5370	17 „	20 „ 14 „	14 „	1 3 0
6832	17 „	20 „ 14 „	17 „	1 3 0
6183	17 „	20 „ 15 „	15 „	1 3 0
4289	17 „	21 „ 15 „	14 „	1 3 0
5270	17 „	22 „ 14 „	14 „	1 3 0
3631	18 „	18 „ 14 „	20 „	1 5 0
3681	18 „	21 „ 14 „	13½ or 16 „	1 5 0
3554	18 „	21 „ 15 „	14½ „	1 5 0
7957	18 „	22 „ 16 „	14 „	1 5 0
8048*	19 „	25½ „ 15 „	18 „	1 8 6

Mouthpieces with Oval Lids for Oval Retorts.

Pattern No.	Dimensions of Mouth.	Internal Dimensions of Retort.	Length of Mouthpiece.	PRICE Lid and Fittings without Mouthpiece.
9800	18 × 14½ ins.	18 × 14½ ins.	15 ins.	£1 5 0
9205	20 „ 12 „	24 „ 14 „	10½ „	1 10 0
10000	20½ „ 14½ „	20½ „ 14½ „	15 „	1 10 0
9680	21 „ 15 „	21 „ 15 „	15 „	1 12 0
10056	21 „ 14½ „	21 „ 14½ „	16½ „	1 12 0
13218	21 „ 15 „	21 „ 15 „	17 „	1 12 0
10514	22½ „ 13½ „	22½ „ 13½ „	13½ „	1 13 0
13766	20 „ 17 „	20 „ 17 „	15½ „	1 15 0
13269	24 „ 15 „	24 „ 15 „	16 „	1 18 0

190

Mouthpieces for Round Retorts.

Diam. .. .. ins.	14	15	16	17	18
Price, Lid and Fittings without Mouthpiece } £	0 19 0	1 0 0	1 1 0	1 3 0	1 5 0

Mouthpieces with Circular Lids for D Retorts.

Pattern No.	Diam. Mouth.	Internal Dimensions of Retort.	Length of Mouthpiece.	PRICE, Lid and Fittings without Mouthpiece.
5348	14 ins.	14 × 13 ins.	7 ins.	£0 19 0
3463	15 „	15 „ 13 „	14 „	1 0 0
6678	15 „	15 „ 14 „	12 „	1 0 0
3661	15½ „	15½ „ 13 „	12 „	1 1 0
13052	16 „	16 „ 13 „	13 „	1 1 0
5601	16 „	16 „ 14 „	15 „	1 1 0
6827	16 „	16 „ 14 „	17 „	1 1 0
4494	16 „	16 „ 14 „	14 „	1 1 0
3548	16 „	16 „ 15 „	12½ „	1 1 0
6677	16 „	16½ „ 13½ „	12½ „	1 1 0
9645	16 „	16½ „ 13½ „	12½ „	1 1 0
4434	16 „	17½ „ 14 „	14 „	1 1 0
6469	16 „	18 „ 14 „	15 „	1 1 0
9015	16 „	18 „ 14 „	18½ „	1 1 0
4327	16 „	18 „ 15 „	15½ „	1 1 0
8049*	16 „	18 „ 15 „	17½ „	1 1 0
6137	16 „	20½ „ 13½ „	13½ „	1 1 0
5918	17 „	18 „ 14 „	14 or 17 „	1 3 0
5053	17 „	19½ „ 12 „	14½ „	1 3 0
7548	17 „	20 „ 13 „	15 „	1 3 0
6468	17 „	20 „ 16 „	15½ „	1 3 0
4316B	17 „	21 „ 14 „	14 „	1 3 0
7975	17 „	21 „ 15 „	14½ „	1 3 0
13459	17 „	21½ „ 13½ „	15 „	1 3 0
12990	18 „	18 „ 15 „	15 or 19 „	1 5 0
7135	18 „	18½ „ 15 „	13 „	1 5 0
10221	18 „	18 „ 16 „	12½ „	1 5 0
4506	18 „	20 „ 13 „	19½ „	1 5 0
6479	18 „	20 „ 13 „	15 „	1 5 0
6818	18 „	20 „ 13½ „	17½ „	1 5 0
4083	18 „	20 „ 15 „	16 „	1 5 0
5306	18 „	20½ „ 14 „	13½ „	1 5 0
13295	18 „	20½ „ 14 „	19½ „	1 5 0
7358	18 „	20½ „ 13½ „	13 „	1 5 0
4569	18 „	21 „ 14 „	18 „	1 5 0
3628	18 „	21 „ 15 „	16 „	1 5 0
7640	18 „	22 „ 13½ „	13½ „	1 5 0
7971*	20 „	20 „ 15 „	18 „	1 11 0

*Patterns marked * have Sockets at back to connect to Retorts; all the others are flanged. Patterns marked* B *have curved bottoms.* 191

Mouthpieces with D Lids for D Retorts.

Pattern No.	Dimensions of Mouth.	Internal Dimension of Retort.	Length of Mouthpiece.	PRICE, Lid and Fittings without Mouthpiece.
12292	15½ × 13 ins.	15½ × 18 ins.	12 ins.	£1 2 0
9967	16 „ 14 „	16 „ 14 „	15½ „	1 3 0
13574	16½ „ 13½ „	16½ „ 13½ „	12½ „	1 4 0
9899	18 „ 12 „	18 „ 12 „	14 „	1 4 0
13980	16 „ 16 „	16 „ 16 „	18 „	1 6 0
13900	18 „ 13½ „	18 „ 13 „	15 „	1 6 0
9912	18 „ 13½ „	18 „ 18½ „	17 „	1 6 0
9962	18 „ 13½ „	18 „ 13½ „	16 „	1 6 0
10982	18 „ 13½ „	18 „ 14 „	15 „	1 6 0
11098	18 „ 14 „	18 „ 14 „	12 „	1 6 0
9492	20 „ 13 „	20 „ 13 „	15 „	1 10 0
9208	20 „ 13 „	20 „ 13 „	19½ „	1 10 0
10251	20 „ 13 „	20 „ 13 „	15½ „	1 10 0
12964	20 „ 13 „	20 „ 13 „	13½ „	1 10 0
9909	20 „ 13½ „	20 „ 13½ „	17 „	1 10 0
12969	19½ „ 15½ „	19½ „ 15½ „	14 „	1 11 0
13781	20 „ 15 „ Front. / 21 „ 15 „ Back.	21 „ 15 „	15 „	1 11 0
7692	21 „ 15½ „	21 „ 15½ „	16 „	1 11 0
12978	20 „ 16 „	20 „ 16 „	17 „	1 11 0
13252	20 „ 16 „	20 „ 16 „	18 „	1 11 0
13220	21 „ 15 „	21 „ 15 „	17 „	1 11 0
8977	21½ „ 13½ „	21½ „ 13½ „	18½ „	1 11 0
8976	21½ „ 13½ „	21½ „ 13½ „	18½ „	1 12 0
10497	21½ „ 13½ „	21 „ 13½ „	18½ „	1 12 0
8037	21½ „ 13½ „	21½ „ 13½ „	18½ „	1 12 0
9908	21½ „ 13½ „	21½ „ 13½ „	15 „	1 12 0
10404	21½ „ 13½ „	22 „ 14 „	18½ „	1 12 0
12410	21½ „ 13½ „	22 „ 14 „	12 „	1 12 0
13822	21½ „ 13½ „	22 „ 14 „	15 „	1 12 0
10515	22½ „ 12½ „	22½ „ 12½ „	13½ „	1 12 0
7924	24 „ 14 „	24 „ 14 „	15½ „	1 13 0
13807	24 „ 15½ „	24 „ 15½ „	16 „	1 14 0
9015B	25 „ 14 „	25 „ 14 „	12½ „	1 14 0
10932	25 „ 14 „	24 „ 14 „	13½ „	1 15 0
12944B	22 „ 16 „	22 „ 16 „	16 „	1 15 0

Patterns marked B *have curved bottoms.* 192

HUNT'S PATENT EQUILIBRIUM DIRECT MAIN

GAS GOVERNOR.

In this Governor a throttle valve is substituted for the ordinary suspended cone; all external communication being avoided by placing the lever or radius arm inside the valve chamber upon the disc.

The disc is carried upon steel centres, upon which it is accurately balanced.

4 ins. ..£17 0	8 ins. ...£25 0	14 ins. ...£42 0	20 ins. ...£60 0
5 „ .. 20 0	10 „ .. 33 0	16 „ .. 46 0	24 „ .. 72 0
6 „ .. 22 10	12 „ .. 38 0	18 .. 50 0	36 „ .. 130 0

196

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ESTABLISHED 1844.] **ORIGINAL MAKERS.** [ESTABLISHED 1844.]

London, 1851. New York, 1853. Paris, 1855. London, 1862.

Dublin, 1865. Paris, 1867.

The SIX MEDALS AWARDED to THOMAS GLOVER for

PATENT DRY GAS-METERS,

The latter being the Highest Medal awarded for Dry Gas-Meters by the Imperial Commissioners for the Universal Exhibition, Paris, 1867.
Since then we have not Exhibited for Prizes.

THOMAS GLOVER & CO.,

DRY GAS-METER MANUFACTURERS,

214 to 222, ST. JOHN ST., CLERKENWELL GREEN, LONDON, E.C.

And at 37, BLACKFRIARS STREET, MANCHESTER.

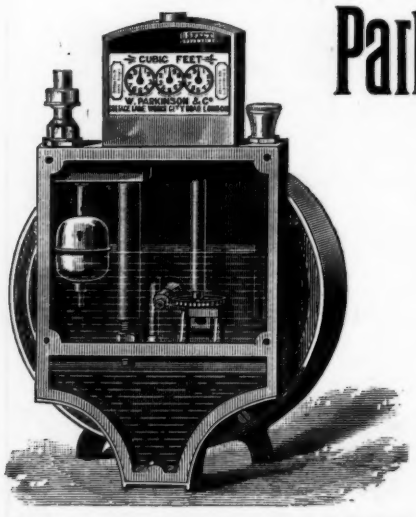
TELEGRAPHIC ADDRESSES: "GOTHIC LONDON," "GOTHIC MANCHESTER." TELEPHONE No. 6725.

1st—Are a remedy for all the defects of Wet Meters.
2nd—Are suitable for all climates, whether hot or cold.
3rd—Incur no loss of Gas by Evaporation.
4th—Cannot become fixed by Frost, however severe.
5th—Are the most accurate and unvarying measurers of Gas.
6th—Prevent jumping or unexpected extinction of the Lights.
7th—May be fixed either above or below the level of the Lights.
8th—Cannot be tampered with without visibly damaging the outer case.
9th—Will last much longer than Wet Meters.
10th—Will not cost more than one-half for repair that Wet or Water Meters do.
Are upheld for five years without charge.

W. PARKINSON & CO.

ESTABLISHED 1816.

MANUFACTURERS OF WET METERS.



Parkinson's Cast-Iron Case Meter.

Works with very little friction.

Will stand very high pressures.

Cannot possibly be shut off by sudden increase of pressure; the float being affected by outlet gas only.

Allows for loss of water by evaporation without materially affecting the registration or shutting off the gas.

Unexcelled for Simplicity of Construction, Excellence of Workmanship, and Accuracy of Registration.

COMPENSATING METERS,

In Tinned or Cast-Iron Cases.

COTTAGE LANE WORKS, CITY ROAD,
LONDON.
Telegraphic Address: "INDEX."

BELL BARN ROAD WORKS,
BIRMINGHAM.
Telegraphic Address: "GAS-METERS."

OFFICE: 10, MAWSON'S CHAMBERS, DEANSGATE,
MANCHESTER.
Telegraphic Address: "PRECISION."

CONTENTS.

EDITORIAL NOTES:— PAGE

GAS, LIGHTING, &c.—
- A Requirement of the Time . . . 1279
- Cutting-Off Notices in Parliament . . . 1280
- Retrospective Increases in the Price of Gas . . . 1280
- An Innovation upon the Sliding Scale . . . 1281

WATER AND SANITARY AFFAIRS—
- The London Water Commission Bill . . . 1281
- The Metropolitan Vestries and the Water Supply . . . 1282

ESSAYS, COMMENTARIES, AND REVIEWS:—
- Gas and Water Companies in the Stock Market . . . 1282
- Electric Lighting Memoranda . . . 1282
- A Remarkable Suggestion . . . 1282

NOTES:—
- Main Laying under Water . . . 1284
- Flexible Metallic Tubing . . . 1284
- The Effect of Chloroform Vapour upon Gas-Flames . . . 1284
- The Cost of Gas and Steam Power . . . 1284

TECHNICAL RECORD:—
- Manchester District Institution of Gas Engineers—The Quarterly Meeting—Discussions of Papers . . . 1285
- Gaseous Illuminants—Fourth Cantor Lecture by Mr. V. B. Lewes at the Society of Arts . . . 1288
- The Gas Undertakings Returns . . . 1292
- American Gaslight Association—The Annual Meeting at Savannah . . . 1293

REGISTER OF PATENTS:—
- Gas-Meter Dials—Danks, A. T. . . . 1294
- Manufacture of Gas—Cotton, W. T., and Crowther, E. F. B. . . . 1294
- Swing Gas Bracket and Mercurial Seal—Stott, J. . . . 1294
- Gas-Engines—Cruikshank, G. M. (White, C., and Middleton, A. R.) . . . 1294
- Patent Notices . . . 1294

CORRESPONDENCE:—
- The Supply of Steam to Regenerator Furnaces . . . 1295
- The Bowman Oxygen Company . . . 1295
- The Heating and Ventilating of Victoria Infirmary, Glasgow . . . 1295

LEGAL INTELLIGENCE:—
- House of Lords—Holliday and Others *v.* The Corporation of Wakefield . . . 1296
- High Court of Justice—Chancery Division—Corporation of Wolverhampton *v.* Bilston Commissioners and Local Board of Health . . . 1296
- Southwark Police Court—The South Metropolitan Gas Company Fined for Deficiency in Illuminating Power . . . 1297

MISCELLANEOUS :—
- The Powers of Gas Companies as to Cutting Off Supplies . . . 1297
- The Cost and Sale of Gas in Edinburgh and Glasgow . . . 1298
- Meeting of the Continental Union Gas Company, Limited . . . 1298
- The Water Gas Industry—Meeting of the British Water Gas Syndicate, the Yorkshire Water Gas Company, and the North British Water Gas Syndicate . . . 1300
- Christmas Time at the York Gas-Works . . . 1301
- The Electric Lighting Scheme for the City of London—Letting of the Western District to the Brush Company . . . 1301
- Meeting of the Chelsea Water-Works Company . . . 1302
- Notes from Scotland . . . 1302
- Current Sales of Gas Products . . . 1303
- Gas and Water Companies' Stock and Share List . . . 1304

PARAGRAPHS.—Altering the Position of a Water-Main while in Use, 1281—Mr. W. Walker, 1283—Glycerine for Preventing Water Freezing in Gas-Meters, 1283—"Calvert's Mechanics' Almanac for 1891," 1284—Preservation of Iron Chimneys and Flues, 1292—The Price of Gas in Brussels, 1292—Society of Civil and Mechanical Engineers, 1293—The Artesian Well Boring in the City of London, 1293—Northern Coal Trade, 1294—Water-Works for Spain, 1295—The Patent Gasholder Syndicate, 1295—The Cardiff Corporation and Unionism, 1295—The Paris Electric Lighting Companies, 1295—The Staines and Egham Gas Order, 1295—Leeds Corporation Gas Affairs, 1295—The Nottingham Corporation and their Gas Employees, 1295—The Gaslight and Coke Company and their Lamplighters, 1297—The Campbell Gas-Engine Company, Limited, 1299—The Price of Gas at Nottingham, 1299—The Finances of the Stockton and Middlesbrough Water Board, 1302—Private Bills in Parliament, 1303—Wivenhoe Gas and Coal Company, Limited, 1303—The Quality of the Water at Leeds, 1303—Lancashire Coal Trade, 1303—The Chairman of the Manchester Gas Committee, 1303—Bilston Gaslight Company, 1303—Leigh (Essex) Water Supply, 1303—The Strike at the Darwen Gas-Works, 1303—Union Intolerance, 1304—The Present Position of the Cardiff Water Supply, 1304—Electric Lighting at Sea, 1304.

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THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, DECEMBER 23, 1890.

A Requirement of the Time.

A FORTNIGHT ago we discussed in these columns the radical difference between the industrial methods of this country and of the United States, which we found to consist in the economy of material and lavishness of labour here as contrasted with the opposite conditions prevailing across the Atlantic. It is necessary now to carry the discussion further, for the purpose of showing that in British industries generally, and in gas manufacture in particular, it is customary to be very sparing of just that description of labour that should be most fully employed—we refer to the labour of the specialist or expert. If British manufacturers travelling in the States are struck with the manner in which hand labour of the unskilled and unintelligent kind is supplanted there by machinery, they have only to go to Germany to be even more amazed at the freedom with which the very highest kind of labour is there employed. Germany is the home of learning. The people are not only teachable and submissive to authority in a degree that makes an Englishman appear by comparison a wild and untameable animal, but they accept the results of learning with an unquestioning thankfulness to which the British, to say nothing of the American spirit is an utter stranger. Thus they not only build schools and colleges, and support them in a style that the British ratepayer would certainly object to, but they do more—they provide careers for the young graduates in artistic, scientific, and industrial learning who are the product of this elaborate scholastic system. It will be observed that we employ the term "industrial learning" to describe what is taught in German technical colleges. No industry can be taught in a school; but every industry worthy of much consideration has connected with it a mass of history, tradition, and theory which can be better taught in an institution of a scholastic character than left to be picked up as he goes along by the student, apprentice, or aspirant in its actual practice. The German idea, which is now being followed more or less closely by other countries, is that the conduct of an important industry is better in the hands of those who have been trained to it first in college and then in the works, than of those who have only the latter kind of experience. Consequently, graduates of technical schools are employed in works in positions which in this country are usually filled by superior men of the mechanic or labouring class. The yard foreman, or head of a machine-shop, will under this system be a trained collegiate engineer or chemist who receives only a small salary—foreman's wages, in short—being young and with a good deal yet to learn. Besides this, in every large industrial establishment room is found for one or more accomplished men who would in England be termed supernumeraries. Usually they are research chemists, or men of special training and insight into matters which it would benefit the concern to know. It is unnecessary here to point out how widely this way of conducting a business establishment differs from the English fashion.

In his pride of habit, the English manufacturer declares that his way of managing his business is good enough for him, and that he does not know what good a research chemist would be in his establishment. Sometimes, of course, a chemist is not the man he really needs; but we take this science as an example. Many industries are amenable to chemical teaching, however; yet in most cases of the kind there is no organization for facilitating research even into collateral issues. These trades simply depend for their prosperity upon the supply of some material at a given cost, or the continuation of some particular process. The owners of such factories would think it an unbearable tax upon their profits to keep a man to study alternative or rival methods; but when these are discovered, they are often compelled to pay heavily in royalties for ability to keep their trade. When it is considered how much money English manufacturers lose through being deceived over new inventions, and the heavy tax they have to pay when their processes are suddenly rendered obsolete, it at least becomes questionable whether a more liberal and far-seeing expenditure upon skilled assistance would not in many cases be a great saving in the long run.

It may be urged with much force that even if chemical, engineering, or other special advice would now and again be valuable to manufacturers, comparatively few are in a position to require it continually; because, after all, no manufacturer can afford to be always running after new processes. He must do a steady and unchanging trade of some kind to pay his way. This is true enough; but what one manufacturer cannot do may be done by many in company. Take the gas industry, for example, as peculiarly suitable for collective action for the general advancement, seeing that there is no question of trade rivalry between the different concerns engaged in it. Gas engineers and managers are associated under different forms for their personal advantage; but this is not the

same as the association of gas manufacturers for the purpose of furthering research into matters which require elucidation for the good of the industry. It is a constant reproach to the representatives of this great industry that they have not organized a system of mutual help for the settlement of problems of admitted importance. By way of illustrating what is meant, we will refer to Mr. Thomson's paper on the incomplete combustion of coal gas in lighting-burners and stoves (*ante*, p. 996), which, for want of a more interested audience, he had to take to a section of the British Association for the Advancement of Science. It did not interest these people; but the subject is of the most pressing importance for the gas industry, seeing that it involves the very question that most affects the popular estimation of gas—the damage done to books, metal-work, ceilings, &c., incidental to the use of gas-lights in shops and living-rooms, and the offensive effluvia given off from some gas heating and cooking stoves. If it were not for these drawbacks to the use of gas, it would be much more generally employed than it is; and whose care should it be to seek into the causes and procure the removal of these evils? The burner and stove makers'? Perhaps; but they produce things mainly to sell. Are they at all likely to thank Mr. Thomson, or anybody else, for gratuitously labelling their wares as being imperfect? A householder, attracted (say) by an advertisement, buys a gas heating-stove that looks neat and suits his pocket. If it smells offensively after he gets it home and shuts it up in his room, where it gives his wife a headache, he may grow disgusted with it; and it is not according to human nature that he should go and buy another. This is where those who are interested in selling gas, not in pushing any particular pattern of stove, and who would like above all things to see gas lifted in popular estimation out of the category of "necessary evils," might be expected to intervene. It is not to be supposed that any unsupported chemist could do the work.

Again, in the processes of gas manufacture the possibility of an appeal to a generally-accepted authority upon a question of a new system would be a wonderful advantage. At present, if a gas company want information upon anything of the kind, they must send their engineer, at considerable expense, to inquire into it; and it does not at all follow that he is the right man for the work. If it is a corporation gas committee, they get up a deputation to investigate matters themselves; and ordinarily return as wise as they went. Who knew anything definite about water gas before Professor Lewes took the subject in hand? and does anybody yet know the whole truth as to the Dinsmore process? Is it quite certain that no independent authority could tell us something worth knowing about the use of oxygen in gas manufacture; to say nothing about the standing problems of naphthalene and stopped ascension-pipes?

The suggestion we have to make, therefore, is that a Research Fund might be founded by rateable contributions from gas undertakings, and that the management of the fund could be confided to a nominated Committee. If only the Metropolitan Gas Companies could be induced to see eye to eye in this matter, they could do it all without feeling the cost. The mere office expenses of such a Committee need only be nominal. Not having any public meetings to organize, their establishment charges would be very small. In fact, there would be no outlay at all, unless upon some definite investigation; and no permanent staff would be required. The Committee might, in a general way, retain a particular consulting chemist and consulting engineer; but whenever a question was started by somebody competent to settle it, if the opportunity and means were afforded for the purpose, the Committee might come to his relief. When we speak of a consulting engineer, moreover, we do not mean a gas engineer, but an authority on strains, or mechanism, or any department of engineering knowledge in which engineers identified with the gas industry may not be adepts. Supposing, for instance, that a chemist of repute should have an idea for working out an obscure relationship between the composition of a coal and its gas or one of its important residuals. Upon application to the Committee they would, if they thought it worth while, grant him £50 or so to go on with his experiments, and hand him over something more if they came to anything. Or if a question of gas manufacture cropped up, the Committee should, of their own initiative, seek out the best man they knew of to inquire into it; paying him well for his trouble. Of course, all the investigations would be published as widely as possible, in order that they might do the greatest amount of good. Without discussing the matter further just now, it may at least be said that the time is ripe for such a movement; and we shall be glad to receive correspondence on the subject.

Cutting-off Notices in Parliament.

In another column will be found the sum and substance of the Bills which The Gaslight and Coke and the Brentford Companies are promoting with a view to the improvement of the law and practice of cutting off gas from private premises. When these Bills are in Committee, we may expect to learn from the eloquence of Counsel more about the reasons for these projects of legislation than can be easily gathered from their preambles. We may say at once that there is nothing in the smallest degree objectionable in either Bill; and it is difficult to conceive that any valid opposition can be raised to their proposals on the merits by the most fidgety of local authorities. The object of both Bills is the same, although their wording is different. Both are declared to have been drafted in order that doubts which have arisen as to the interpretation of the cutting-off provisions commonly relied upon by statutory Gas Companies may be set at rest, and the procedure in such cases defined too clearly for future dispute. Neither proposes much difference in the manner in which premises may be entered and gas cut off inside; but there is a distinct alteration in regard to the proposed authentication of cutting-off notices. The Gaslight and Coke Company ask that such notices shall be deemed sufficient if signed by the "secretary, officer, "or servant, as the case may be, or bearing his name or "signature printed, lithographed, stamped, or engraved "thereon." The Brentford Company's proposal is that every "such notice as aforesaid shall be signed by the secretary or "other duly appointed officer of the Company, and may, to-"gether with the signature, be partly in writing and partly "in print, or wholly in either one or the other; and all such "notices may be served personally or by post addressed "to the premises to which they relate." With the exception that it may be considered fairer to send such notices by hand than to trust them to the post, this suggestion seems rather preferable to the other, since to derive authority for cutting off a supply from any "servant" of a Gas Company may be regarded as offering an insufficient guarantee to the public. We do not at present desire, however, to discuss these "projects of law," as the French would call them. The gist of the matter appears to lie in the requested authorization of a notice with the responsible officer's name printed or stamped instead of written. Readers of the Journal know that these Bills originated in the trouble recently experienced by the Brentford Gas Company with a County Court Judge and jury with reference to one of their cutting-off notices. The Company have never given their version of the incident; and therefore the world is left in ignorance as to whether their trouble came through sending a notice unsigned, or merely with a stamped or printed signature. Cutting-off notices stamped with the secretary's name are commonly used all over the country; and before this Brentford case, nobody questioned their sufficiency. There is reason to believe, however, that according to strict law a stamped name is no signature for any legal instrument; so that, notwithstanding the labour entailed, all cutting-off notices must bear a written signature until the law is altered. To a Gas Company this class of business is the merest matter of routine; but it remains to be seen whether the Legislature will further mark it as such by legalizing a signature *pro formâ*. If this is the only reason why these two Companies are in Parliament, other Companies whose secretaries or their deputies for this purpose are not too busy to personally sign cutting-off notices need not follow their example.

Retrospective Increases in the Price of Gas.

A curious point of gas administration has sprung up in Edinburgh, as recently noticed by our correspndent in that capital, and more lately in Nottingham, as mentioned in another column to-day. It is as to whether a rise in the price of gas can be made retrospective. In Edinburgh the Commissioners raised the price in July, but made the advanced rate operative as from the previous April; and in Nottingham the Town Council raised their price as from Mid-

summer on July 7. It is true that in the latter case the Gas Committee gave notice of their intention to recommend a rise in price as early as June 12; but, of course, this announcement had no legal force. Gas consumers in both localities are now agitating against the retrospective action of the authorities, which they contend is illegal. It appears that this point is to be tested by process of law in Edinburgh; and if the Nottingham Corporation persist in their action, the same thing may happen there. With all due regard to the hazards of interpretation of untested legislation, we make bold to assert that the consumers will probably be held to be right in this matter. We are not aware that the point has ever come before the Courts. Instances are known of retrospective reductions of price; but it is one thing to give away money, and another to recover it by law. Without pretending to any authority on the legal question, we nevertheless incline to the opinion that notice of a rise in price must be given before the date on which it is to take effect, in order, for one thing, that consent may be assumed. Apart from law, however, it would be bad policy to allow boards of directors or committees to play with time past as well as with time to come. If they cannot manage their affairs without making retrospective advances of price, it argues a lack of foresight that renders them unfit for their responsibilities. They may do what they like with the future; but surely it may be held that, for them as for other people, the past is beyond recall.

An Innovation upon the Sliding Scale.

In the Board of Trade report on this year's Provisional Orders, mention is specially made of the Aldershot Order, in which—at the instance of the Local Board, who opposed the Confirmation Bill in the House of Lords—clauses that had been accepted by the promoters were inserted, fixing a sliding scale of price and dividend. The initial price was put at 3s. 8d. per 1000 cubic feet; and the increase or decrease of dividend for every penny of reduction or increase of the initial price was fixed at 3s. per cent. instead of the usual amount of 5s. per cent. This is too important a departure from custom to pass without comment; and it would be well if the reasons for it could be recorded alongside the precedent itself. The customary rule of one-quarter per cent. of dividend for a penny of price is so simple, and has worked so well, that it is impossible to regard any innovation with undisturbed equanimity. The usual proportion is liberal enough to the public; seeing that it generally means giving the consumers four or five times as much as the shareholders receive. This Aldershot rule would, however, give the public a good deal more. But progress in this direction is checked by the consideration that a sufficient inducement must be held out to the shareholders for them to properly apply the sliding scale; and the Ashton case showed that even 5s. for a penny is not universally sufficient for this end. If the proportions between dividend and selling price are dodged about in this manner, the thing will become a terror. Of course, the precedent is limited by the consideration that the Gas Company accepted the alteration, for reasons of their own which do not in the least bind others; but why such an awkward figure as 3s. for a penny? It can never work out to the usual whole-number dividend with aliquot parts. Even 4s. for a penny would have made matters look more uniform in this way. The idea of any unnecessary alteration in the relations of dividend to selling price under the sliding scale is repugnant to sound principle. What is good enough for every Gas Company and local authority that have made a fresh settlement of their mutual arrangements during the last fifteen years ought to serve for small places where any possible difference that can be hit upon must be essentially insignificant save in repute. Confusion would come again if every Gas Company in Parliament were invited to make a deal with the local authority with regard to the proportions in which surplus profit should be divided between the proprietors and the public. Perhaps it would be too much to expect of the promoters of a Gas Bill opposed in the Lords that they should consider the effect upon others of their striking strange bargains of this class; but it may not be wholly purposeless to ask them to pause for their own sakes, and consider whether they are more likely to gain or lose by consenting to any infringement of a rule that has, on the whole, done so much good to gas consumers as well as to shareholders. Local authorities we may expect to be short-sighted. It is the natural consequences of their popular origin; but the Directors of Gas Companies should be regardful of other considerations than those of the moment.

WATER AND SANITARY AFFAIRS.

The London Water Commission Bill of the Corporation is now before us. Its main purpose is to constitute a Public Authority to promote Bills in Parliament for "improving the supply and diminishing the cost of water" in the City of London and the County of London, together with adjoining boroughs and populous places. The preamble of the Bill declares it expedient to constitute a Public Authority "which shall represent the interests and command the confidence of the water consumers, and which shall, with the authority of Parliament under any subsequent Act, provide or regulate a supply of water to the whole or part of the area" already mentioned. The Bills contemplated for introduction, if the present measure is passed, include such as shall confer power on the Commission to construct new works, or to purchase any that now exist, as well as to regulate the charge for water and the dividends paid by any Company prior to the acquisition of their undertaking, so as to secure a uniform rate to be charged throughout the area. The Commission is to have full power to make inquiry into the existing supply, and the charges made for the same, as well as into the present and possible future sources of such supply. The Commission is to consist, in the first instance, of 51 members, to be called "original members," including two of *ex officio* rank—namely, the Lord Mayor of the City, and the Chairman of the London County Council. The remaining 49 members are to be nominated by different authorities—one by the President of the Local Government Board, another by the President of the Board of Agriculture, five by the Corporation, twenty by the London County Council, four by the County Council of Middlesex, the same in the case of Surrey, three by the County Council of Essex, one each by four other County Councils and by seven Corporations, extending as far as Oxford. Parliament may from time to time direct additional members to be nominated by certain other authorities. The first meeting of the Commission is to be held on Nov. 2, 1891; and all are to vacate office on July 1, 1896, when a fresh election is to take place—the same process occurring at the end of each quinquennial period. Outgoing members will, of course, be eligible for re-election. There is to be paid to the nominated members of the Commission such reasonable sum for their attendance and expenses as the Local Government Board shall prescribe. Paid officers and servants may be appointed by the Commission.

Obviously all this machinery is not to be worked without money; and the question naturally arises where it is to come from. According to one clause in the Bill, sums of money, not exceeding in the whole £5000, are to be advanced by the City Corporation to the Commission within two months from the passing of the Act, to be repaid, with interest at the rate of 3 per cent. per annum, so soon as the Home Secretary considers the Commission to be in possession of funds conveniently available for the purpose. How these funds are to come into existence only appears by a clause giving the Commission power to promote a Bill, making provision for the raising of money on the security of such stock, debentures, or preference or deferred shares or annuities, whether perpetual or redeemable, as may be required for the purpose of carrying into effect the provisions of any Act of Parliament which the Commission may obtain. Supposing the present Bill to become law in 1891, it will be necessary, or at least expedient, for the Commission to get another Bill passed in 1892, enabling them to obtain possession of the London Water Supply, or some part of it, so that they may command a revenue to pay fees, salaries, rent, wages, and working expenses in general. If this be not done, steps will have to be taken to legalize some further draw on the Corporation. The accounts, we observe, are to be subject to an audit under the direction of the Local Government Board; and an abstract is to be laid before Parliament. Palpably, the present Bill is to be introductory to another; the latter to compass one of two things—either to authorize "an alternative or independent water supply," or to

provide for the purchase of the undertakings now possessed by the Water Companies.

Abundant criticism will doubtless be exercised on the scheme brought forward by the Corporation; and the authorities of the outer area who happen to be omitted from representation will naturally feel themselves aggrieved. In other quarters objections will arise to the creation of a new authority with its staff of officials. Competing with the scheme of the Corporation, there is the Bill of the Vestry delegates, proposing to transfer the London Water Supply to the County Council or to a Trust. But assuredly if the County Council get possession of the water supply, they must have an accession to their ranks, both in members and in officers. The Committees formed out of the Council are already over-burdened with work; and their task is not growing lighter as time passes on. Sir William Farrer, speaking at the Vestry of St. George, Hanover Square, last week, said he did not think that the Government would listen to any proposal which did not come backed by the London County Council. We venture to think, however, that the County Council, as at present constituted, is altogether unequal to the management of so vast a concern as the water supply of London. But the entire question, as we have remarked before, is in a very crude and inchoate condition. With regard to tha Bill brought forward by the Vestries, it is a little amusing to find that the Lambeth Vestry have just adopted the report of their Parliamentary Committee, recommending that they should "heartily support the Bill promoted by "the Corporation." As for the intervention of the Government in this matter, there is more than one reason rendering such a step highly improbable. The local authorities of London are not agreed as to the mode of dealing with the water supply. The County Council are taking a course distinct alike from the Bill of the Corporation and that of the Vestries, and are asking the Government to institute an inquiry as to "whether any and what "steps should be taken to provide a new and better "supply." This is just what the Government would like to be told by the local authorities. If the latter do not know their own mind, there is little chance that the Government will do the brain work for them. The aspect of affairs is altogether such that there seems a very remote likelihood of any substantial progress being made with the London Water Question during the coming year. The panic raised on the subject of the quinquennial valuation will probably die away, when the actual result as concerns the rateable value comes to light. If we are correctly informed, the effect on the districts of two of the London Water Companies will be such as actually to lower the total rateable value, instead of increasing it. Certainly, in many cases house property in London takes a lower rateable value now than formerly. Amid all the controversy and excitement which has gathered round the Metropolitan Water Question, it is satisfactory to find the Companies keeping steadily at their work, and reaping a well-earned reward, as in the case of the Chelsea Company, which now for the first time has declared a dividend at the rate of 10 per cent. per annuum. Whatever may be now said to the contrary, experience will prove that the prosperity of the London Water Companies is not due to the abuse of a monopoly, but to the exercise of administrative skill and ability.

Altering the Position of a Water-Main while in Use.—In the minutes of the proceedings of the Institution of Civil Engineers, reference is made to a contribution made to the *Journal of the Royal Institute of Engineers of Holland*, by M. Stang, on the subject of changing the position of a water-main while in use. The alteration took place at the Hague. The pipe was the principal water carrier; and, of course, any cessation of the supply would have been attended with inconvenience. M. Stang decided to try slewing the pipe sideways without stopping the supply. The main, when full, weighed 524 lbs. per yard; and the length to be moved being 273 yards, the total mass weighed 65 tons. When the main had been laid bare, a trench was dug alongside, reaching a little deeper than the under side of the pipe, which was then suspended by chain slings and screw-bolts and nuts to beams laid across the trench. While the nuts were being turned, over the whole length of the operation, and at the same time slid sidewards, the earth on which the main had been resting was slowly dug away, allowing the main to swing sideways. The operation was repeated two or three times till the pipe was in its desired position. During this time the pressure was reduced from 3 to 1½ atmospheres No leaks of importance occurred in the lead joints.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 1304.)

THE past week has been a singularly quiet one in the Stock Exchange. After the recent excitement, came the natural sequence and reaction of calm; and the near approach of the Christmas Holidays disposed many to enter into no fresh engagements yet awhile, but rather to put off the outburst of activity until the new year. If anything more were wanted to induce general quietude, the weather furnished it. It is not often that the severity of the weather has to be taken into account as a check to business in Capel Court; but last Friday the heavy snow and the consequent impediments by rail and road kept many away, while on Saturday the Exchange was almost deserted. As might be expected, prices have rather tended downwards; but there is no appearance of anything in the nature of a fall to cause the slightest uneasiness. The Money Market continues easy, and will in all probability become easier rather than harder. Gas, like all the rest, has been a quiet market; but it keeps firm enough, and the balance of changes in quotation is decidedly on the side of increase. Of the Metropolitan Companies, Gaslight "A," after pursuing the see-saw motion of rising 1 higher one week and falling 1 lower the next, did better last week and advanced 2½, with business done at 239. The secured issues were very fairly supported; more especially the 6 per cent. debenture stock, which was in good request and improved 1. As it stands, it is the cheapest first-class debenture stock in the market. The "K" 6 per cent. preference stock also rose 4, and business was done in it at 150½. South Metropolitans have been moderately dealt in; and, in result, the "A" figures 3 lower and the "B" 2 higher. Commercials are firm and unchanged. The Suburban and Provincial Companies have furnished but little business. Crystal Palace is quoted 5 better; but no transaction was marked in it. Of the Foreign group, the Continental undertakings have been the most active. Imperial Continental, after being done at 225, receded half a point. Continental Union, however, was 1 higher. South Americans were fairly steady and unchanged; and the rest presented no remarkable feature. The Water Companies have been rather active, especially Kent; and many of them have effected slight improvements in value, ranging from 1 to 2 per cent.

The daily operations were: All Gas issues were very quiet on Monday, except Imperial Continental, which almost had the market to itself. Prices were rather wide. Quotations for Gas and Water stocks remained unchanged. The Gas Market continued lethargic on Tuesday; and the only move was a rise of 5 in Crystal Palace. In Water, Kent improved 2; and Chelsea, 1. Gas was more active on Wednesday, and showed general firmness. Gaslight "A" and South Metropolitan "B" rose 1 each. Water was again on the rise, both Lambeth issues advancing 1. Movements in the Gas Market were irregular on Thursday. Gaslight "K" rose 2; and Continental Union and South Metropolitan "B," 1 each. But South Metropolitan "A" receded 3; and Imperial Continental buyers offered 1 lower. Gas stocks in general were firm on Friday. Gaslight 6 per cent. debenture rose 1. East London Water also advanced 1. There was the usual quietude on Saturday; but Gas was inclined to go better, in view of the favourable climatic condition. Gaslight "A" gained a further 1½; and ditto "K," 2.

ELECTRIC LIGHTING MEMORANDA.

Failures of Electric Lighting in Dark Weather—The Chelsea Company and Mr. R. Chamberlain, M.P.—The City of London Street Lighting—Mr. F Bailey's Paper at the Society of Arts.

THE spell of cold and dark weather which has prevailed for many days over the south-east of England, and particularly over the Metropolitan area, has severely strained the arrangements of such of the London electric lighting companies as have actually begun to work. Complaints of low pressure and frequent interruptions of the service are rife; and the electricians are learning, with a feeling nearly akin to disgust, that consumers judge a lighting service not by its average excellence, but by its occasional lapses from perfection. Being new to the business, the electricians take this severity of judgment as very hard. They seem unable to enter into the feelings of a shopkeeper who has adopted electric lamps for the sake of advertisement, and who finds his show-rooms and windows left without light for several hours on a dirty, dingy day. It is nothing to him that he has had plenty of light all the rest of the year. He would say, indeed, if reminded of the fact, that this is only what he expected and paid for. He does not see the necessity of feeling grateful because those with whom he has contracted for the supply of a particular commodity, serve him fairly well on the average; and he holds himself quite free to find fault if the supply fails for a moment. Such is the way of the world; and electricians must submit to it. At present, the only electric light companies in London that have not received complaints of defective lights are those whose plant is not half in use. It does not look very promising if the nearer an electric lighting company approaches to profitable employment of their plant, the more likely they are to disappoint their customers.

A bitter controversy is raging between the Chelsea Electric Lighting Company and Mr. Chamberlain, M.P., who, as reported

in our last issue, called attention in Parliament to the defective service given by the Company. The Company replied through the newspapers that their service was not defective; and they imputed an interested motive to their critic. Mr. Chamberlain lost no time in returning to the charge, declaring that "the Company undertake to give their consumers 100 volts, and they have egregiously failed to do so; the average during lighting hours being from 96 to 98, and going down during the recent fog to below 88; while on Saturday morning last they broke down entirely, and for eight hours there was no current available whatever. To-day also from an early hour all supply has been cut off. Meanwhile, I write by candle light, and with my house in darkness." This letter is dated Dec. 15. The peculiar gravity of the complaint follows from the consideration that this Chelsea Company flattered themselves on the possession of a system of producing and distributing electricity for lighting that was as superior to risk of interruption for even an instant as money and skill could make it. For the sake of ensuring reliability in the service, regardless of cost, they have made a more extensive use of storage batteries than any other lighting company in existence. And now they have had as bad a breakdown, at an awkward juncture for them, as any direct-supply company who scorned to use accumulators. It is a vexatious experience. Once allow the public to conceive the idea that electric lighting by a central station company is a fair-weather and summer-time luxury, and that company's prospects will be inevitably ruined.

The Brush Company have got hold of the Commissioners of Sewers of the City of London, and will probably work their advantage for all it may prove to be worth. As yet no electric lighting whatever appears in the City streets, although the Commission have been for six years trying to settle street lighting contracts with different companies. The Thompson-Houston people have arranged to take one of the districts into which the City was divided for the purpose of securing comparison between the contractors; and the Brush Company had another. Now they have obtained a second district, which means, if the Board of Trade permit the arrangement, a 21 years' monopoly of this Company over the greater part of the City of London. When this was pointed out to the Committee who recommended the acceptance of the Brush tender, the Chairman plaintively declared that the terms were the best they could obtain, and that the Brush Company's was the only tender they had received. It was therefore a question with them of taking this offer or going without electric lighting altogether, which they were ashamed to suggest as desirable. The City authorities are evidently at a loss to understand why, after so many protestations of their readiness to go anywhere and do anything, the electricians should prove so backward when the lighting of the richest capital in the world is offered to them. This certainly is a matter the "true inwardness" of which does not appear on the surface.

Some very instructive things, and not a few decidedly funny ones, were said at the Society of Arts meeting mentioned last week, in connection with Mr. F. Bailey's paper on the progress of electric lighting in London. Sir F. Bramwell presided on this occasion, and patronized the author and the subject with his customary imposing affability. There is nothing more noteworthy in the history of electric lighting in England than the clever way in which this eminent engineer has managed to constitute himself one of the of the representatives and protectors of the new industry. To return to the immediate subject, however, Mr. Bailey was naturally anxious to persuade his audience of the cheapness of incandescent electric lighting at current rates, which, by the way, are not likely to be lowered. He set out some elaborate tables of the cost and performances of lamps, (taking them, of course, at their best), from which he deduced the comfortable assurance that "with ordinary care, the average cost of burning an 8-candle power lamp for ordinary domestic use need not exceed 10s. per annum." It appears, however, that this will only be true of those careful people who invariably turn out lights the instant they are finished with. That this is not generally done with gas is put down to the necessary trouble of hunting for matches and gas-taps, and the risk of breaking globes, &c. It is an innocent assumption; but we fear that not even electricity will suffice to cure domestic carelessness and waste. If it could be depended upon to have this result, many a poor householder would lay on a supply at any price.

Mr. W. Walker, of Bournemouth, has been selected to fill the position of Outdoor Superintendent of the Tunbridge Wells Gas Company, applications for which were invited, by advertisement in the JOURNAL for the 2nd inst., to be sent in to No. 1883.

Glycerine for Preventing Water Freezing in Gas-Meters.—In frosty weather, trouble is frequently experienced by the freezing of water in gas-meters; and the use of glycerine is usually resorted to as a preventive. Messrs. Domeier and Co. write to say they have had, during the past few weeks, many inquiries as to what quality of glycerine is most suitable for the purpose; the general opinion being that it must be chemically pure. They think it will therefore be of interest to our readers to know that a crude glycerine, costing about £30 per ton, answers all purposes; and as only a small quantity is necessary, the expense is very trifling indeed.

A REMARKABLE SUGGESTION.

THE Society of Arts have deserved well of the gas industry of the country in selecting the subject, and the lecturer, for the series of Cantor Lectures which was brought to a close last night. This may not be the only opportunity we shall have of referring to these most instructive discourses; and therefore we shall only say for the present that they may be considered to express the latest word of chemical science respecting one of the most important and pressing of the practical issues actually engaging the minds of British gas manufacturers. Professor Lewes's statements read like a response to much that has been formulated and discussed in the JOURNAL during the last twelve months. All the incidents in the water-gas propaganda, all the controversies about carburetting gas and satisfying gas examiners, are summed up by him with a comprehensiveness of grasp, and criticized with a keenness of insight, that fully establish his right to be included in the first class of living authorities on the chemistry of gas lighting. We confess that at different times, when commenting upon various aspects of the question of water gas, which Professor Lewes has made his particular study during the past year, we have put to him several queries which have till now remained unanswered. He was evidently reserving himself for the opportunity of treating the whole subject systematically which has now been given to him by the Society of Arts; and we therefore hasten to acknowledge that this was the best course he could have followed, and that he has succeeded in the task he set himself.

It may be remembered by those who have followed the discussions of the water-gas question in these pages, that the principal point which we expressly reserved as unsettled by all that had been published respecting the performances of the Van Steenbergh and other systems of preparing carburetted water gas, was that of the economical treatment of the light-giving hydrocarbon fluid. It will be as well, however, as these discussions took place some time ago, to recapitulate the matter. In the case, therefore, of the employment of fluid carburetters for water-gas, the object is attained by three methods in common use. First, there is the gasoline method, in which a wholly volatile liquid is taken up cold by the stream of gas. In this way, all the fluid goes into the gas, and it is merely a question of the price of the article and the standard of illuminating power. These two data being given, the quantity of carburetting fluid required is easily ascertained; and it does not require any very special arrangements for applying it. When the carburetting liquid is not wholly volatilizable, however, the problem arises of how to get the most out of it for the benefit of the gas. It can be carbonized like coal in a retort externally heated, when it usually leaves one-half of its original weight behind in the forms of soot, pitch, and tar. The other methods of gasifying the oil are by putting it into the incandescent carbon of the generator, while the process of decomposing steam into water gas is going on, or by roasting it in a fire-brick "superheater" in the current of hot water gas already made. Nobody seemed to be able to give a valid chemical reason for preferring one of these two latter methods to the other, though the conditions in each differed so widely from the chemical point of view. It was clear that there ought to be a vast difference of some kind between gasifying oil in live fuel and on dead fire-bricks; but whether or not this was so nobody knew with any approach to definiteness. Preference between the two methods was determined by the character of the oil required to be used. Heavy oils could be most satisfactorily dealt with in a fire-brick superheater, followed by a "fixer" of the same nature. Light naphthas did very well in the live fuel, and did not require any subsequent fixing. Still, however, there was no hint of the existence of any fundamental difference in the nature of the work done by these different classes of apparatus. The choice between them was settled by technical and commercial considerations, without reference to chemistry. The superheater plants for the treatment of heavy oils stood at the bottom of a scale in which the *sine*-superheater plants occupied an intermediate position, while the cold carburetting systems stood at the top. If a gas maker undertook to carburet with heavy oils, he knew that he would have to be wary of turning them into lampblack on the one hand, or into tar on the other. He who preferred to carburet with gasoline had neither of these mischances to fear; but he had to pay dearer for his more convenient carburetting material.

When Professor Lewes took water gas in hand, the absolute dearth of chemical data in connection with the manufacture naturally struck him, a chemist, very forcibly; while the haphazard style of the gas-making arrangements offended his trained gas examiner's sense of precision. Accordingly, he set to work to ascertain, in the first place, by means of the apparatus placed at his disposal (which happened to be the Van Steenbergh plant) how illuminating water gas was made, and at what cost for material. If his attack upon the general problems of water-gas manufacture was made through the Van Steenbergh gate, so to speak, instead of through that of Lowe, Flannery, Loomis, or any other design of water-gas plant, it is due to the purely accidental circumstance that this gate was the one that was opened to him. Fortunately for the interest of chemistry, this particular design happened to be the one from which a chemical inquirer might hope to learn most, inasmuch as in it the carburetting oil is

treated in the live fuel of the gas producer. Thus, if there was any difference between the results of gasifying oil in this way instead of upon heated fire-brick or in a hot retort, Professor Lewes was in the direct way of finding it out. That he did find out something of the kind which had not been discovered before, will be perceived on reading the lecture we publish, practically *verbatim*, to-day. The principal effect of working with a column of incandescent fuel as the means for gasifying the carburetting oil is the modification of the composition of the resultant gases in the direction of reducing the carbon monoxide, which is a distinct advantage, not merely on the ground of safety in the use of the gas, but its substitution by hydrogen to so large an extent probably also means a reduction in the quantity of carburetter required for the production of a given illuminating power, hydrogen being a much better carrier of hydrocarbons than carbon monoxide. The fact that Van Steenbergh water gas takes a comparatively small quantity of oil for its photometrical quality, is more explicable in this way than in any other. It cannot be said, however, that we yet know anything reliable about the working of water-gas plant continuously in an English gas-works.

It has always been felt, moreover, that while water gas, whether for supplementing the stock of ordinary coal gas on occasions of sudden and protracted fog, or for carburetting the latter in lieu of cannel gas, is interesting enough to talk about; the primary question is that of its cost. This, for English gas managers, means the cost of the hydrocarbon; for the value of the coke required in water-gas manufacture by any accredited system is nothing very terrible. While the selling price of Russian and American petroleums suitable for water-gas making ranged about 5d. per gallon, they were obviously out of the reach of the average British gas manager. Even with the promise of the certainty of being able to buy oil under contract for 4d. per gallon, the British gas manager could not rest content; for there is no certainty of an unfailing supply at this figure, and, in addition, there was the drawback that the supply would be a foreign one, liable to nobody knows what interfering influences. Besides, there can be no questioning the truth that the war made by the United States and Russian Governments upon British trade, by means of hostile tariffs, has inspired our people with a deep distaste for sending money to these countries for the purchase of any materials that can be done without, or substituted by home products. We have no protective tariff; but the sentiment against unnecessarily sending money to nations that try to do without our goods, bids fair to take the place of a tariff to a considerable extent, especially in case of a proposed new departure in commerce. Taking one consideration with another, therefore, the foreign origin of the hydrocarbons required for carburetting water or coal gas would always have proved a heavy drawback to their popularity in the United Kingdom, at least while native cannel could be had at anything like a possible figure.

In this difficulty, Professor Lewes comes to the rescue with the most startling suggestion yet advanced in connection with the problem of carburetting gas. He assures his countrymen that they have all the necessary material for the purpose, in the recovered oils from blast-furnaces, coke-ovens, &c., which have hitherto been of small value and limited application. These "phenoloid oils," as they are called, have not been suitable for direct application as gas enrichers, because, like the creosote oil of tar, they give, when so treated, much soot or pitch, and only a little gas of no illuminating value. It is now asserted that by a simple intermediary process, the invention of Mr. W. Staveley, all these dead oils are made to yield a valuable carburetting material without detriment to their value for timber preservation. The basis of this carburetting derivative from the heavy oils is none other than benzene—the most desirable of all descriptions of hydrocarbons for the duty of increasing the illuminating power of coal gas. This is a truly wonderful revelation; but, coming from such an authority, the statement will command respect. To assure the British gas manager that he can obtain, if he wants it, an unlimited supply of home-raised carburetting fluid at a reasonable price, and this derived from products of the combustion of coal that have hitherto been wasted, is to bring him good news indeed. If Professor Lewes had been one of those enthusiasts for aërial sanitation who plague the public from time to time with projects of smoke abatement that strike one as originating in a lunatic asylum, he would, as he confesses, have expanded the possibilities of Mr. Staveley's discovery in the too familiar manner. Being intensely practical, however, he kept to the main point; leaving the consequential advantages of the discovery to approve themselves in the fulness of time. Such as it is, Professor Lewes's citation of Mr. Staveley's process is the most remarkable contribution, not only to the water-gas problem, but also to the question of the carburation of coal gas, that has been made in recent times. It is emphatically a matter that must be heard of again before long.

"Calvert's Mechanics' Almanac for 1891," of which we have received a copy from the author, contains a quantity of practical information useful to artizans and handicraftsmen. As the work has reached its eighteenth year of publication, it has evidently been found to fully justify its second title of "Workshop Companion."

NOTES.

Main Laying under Water.

A contribution to the records of main laying under water was recently published in the *Engineering Record* by Mr. E. C. Cooke. It referred to a method adopted for laying about 300 feet of 16-inch water-main in water about 10 feet deep. The bottom was level sand, in which a trench was dredged to receive the pipe. A raft was constructed of empty petroleum barrels, borrowed for the purpose under promise to be returned uninjured. These were put together in a line, with their swells touching; being retained in position by stringers of planks. A double line of barrels was used; the pipe being put together upon bearing-pieces spanning the two rafts. When it was all jointed and caulked, transverse beams were laid over it on the rafts; and the pipe was hung from these beams, the ends of which were supported on packings, and the bearers removed. It then hung directly over the water space between the rafts, and was lowered into the trench prepared for it by simultaneous slacking of the slings. No pulley-blocks were employed, the friction of the ropes being relied upon instead. The job was considered cheap and satisfactory; and no leaks were known to have been caused by the lowering operation. Another large main was laid under water in a similar fashion, except that it was lowered from ordinary tripod derricks set upon the floating platform.

Flexible Metallic Tubing.

Many attempts have been made to produce flexible tubing composed wholly of metal; but so far with but partial success. The difficulty is in obtaining a high degree of flexibility, such as is required for a gas connection to a semi-portable lamp or stove, while at the same time preserving the tube gas-tight, and enabling it to be cheaply made in ordinary non-oxidizable metal. According to a paper presented at the Richmond meeting of the American Mechanical Engineers, these requirements have been met by Mr. T. R. Almond, who claims to have succeeded in producing a flexible metallic tube which will convey gases, steam, and fluids under considerable pressure. It is made in a simple and most ingenious way by coiling round wire on a mandrel, as in making a close spiral spring, and putting a similar coil of wire of triangular section between the coils of the round wire. The triangular wire is wedged between the round coils with sufficient force to keep them apart, so that the contact surfaces are always under pressure; and the heavier the internal pressure the tighter the contact between the coils. When such a tube is bent, the convolutions of the triangular wire coil adjust themselves easily to the spaces of varying width between the round wire; the two coils preserving contact, and remaining gas-tight. This method of construction has only been applied in the production of flexible metallic tubes of small bore.

The Effect of Chloroform Vapour upon Gas-Flames.

In a recent issue of the *Journal für Gasbeleuchtung*, some remarks were made on a point of curious chemical interest. It is stated, as a fact not generally known, that it was to an accident arising out of artificial lighting that the world owes the discovery of chloroform and chloral, which have been of such invaluable service in alleviating human suffering. In the latter years of the reign of Charles X. of France, on the occasion of a ball at the Tuileries, the saloons were found to be filled with a suffocating vapour, in which the wax candles burnt with a smoky flame. Dumas the chemist was called in to clear up the mystery of this occurrence; and he traced it to the candles, the wax of which had been bleached by means of chlorine. Liebig took up the study of the effects of chlorine and alcohol; and the uses of chloroform were soon afterwards discovered by Simpson, as that of chloral was by Liebreich. This remarkable history recalls a curious discovery of Herr von Pettenkofer which was brought before the German Gas Managers' Association at their Munich meeting, upon the influence of the vapour of chloroform upon coal-gas flames. According to this authority, when open gas-flames are used to light the operating theatres of hospitals, the lights, which necessarily have to be near the subject, decompose the vapour of chloroform which is present in the atmosphere of such places, and the first evidence of what is going on is a distressing cough which affects those breathing the air. The only way to avoid this trouble is to use enclosed regenerative gas-lamps, supplied with fresh air, and discharging the products of combustion into the outer atmosphere.

The Cost of Gas and Steam Power.

It is stated that one of the most economical gas-engines now in the market is the Campbell, which is manufactured by the Campbell Gas-Engine Company, of Halifax. This engine has been before the public for some time; but a new model has recently been developed which is specially worthy of attention. Thus a Campbell nominal ½-horse power engine is reported to be capable of working up to 2¾-horse power with a gas consumption, when fully loaded, after the rate of rather less than 22 cubic feet of gas per indicated horse power per hour, which is very low for so small a motor. This consumption of gas for raising power in a small way may be compared with the results of the Royal Agricultural Society's Plymouth tests of small steam engines, mentioned in a "Note" in the last number of the JOURNAL. Taking the question of the cost of fuel alone, and

valuing the 22 cubic feet of gas required to develop a horse power in the Campbell engine after the rate of 2s. 6d. per 1000 cubic feet, the net cost will be 0·66d. If an average small steam-engine burns 8 lbs. of coal per indicated horse power per hour, the cost with steam coal at 20s. per ton, or 1s. per cwt., will be 0·85d. per hour. In other words, the gas power at the price stated would be cheaper in first cost for fuel than steam, wherever coal is worth more than 8·64d. per cwt.—that is to say, in most places.

TECHNICAL RECORD.

MANCHESTER DISTRICT INSTITUTION OF GAS ENGINEERS.

In the JOURNAL for the 2nd inst., a brief account was given of the business which engaged the attention of the members of the above Institution at their Quarterly Meeting held at the Memorial Hall, Albert Square, Manchester, on the previous Saturday, under the presidency of Mr. W. W. HUTCHINSON, of Barnsley; and we have since published the three papers which were read respectively by Mr. W. R. Chester, Mr. W. Gadd, and Mr. Thomas Newbigging.

A COMBINED WASHER TAR EXTRACTOR, AND EXHAUST REGULATOR.

After the transaction of the formal business, a discussion took place on Mr. G. E. Saville's paper, describing his combined washer, tar extractor, and exhaust regulator—read at the previous meeting.* The author again briefly explained the nature of the apparatus, and the advantages he claimed for it.

Mr. ISAAC CARR (Widnes) said that the apparatus seemed to be exceedingly simple; and he should think it was very effective. It appeared to realize one of those happy ideas which sometimes occurred to gentlemen like Mr. Saville, but which was so simple that one wondered why it had never been thought of before. As he understood it, the action of the exhauster had precisely the reverse effect that this apparatus had upon the anti-dip pipe. When a vacuum came on the ordinary dip-pipe and hydraulic main, air was drawn in. But with this apparatus, if air was drawn into one chamber, it was made up by a supply from another; and *vice versâ*, when there was back-pressure, water was forced out of the washing chamber and down the overflow-pipe. One point about which he was not clear, was that of the tar running over. In the Livesey washer, the tar was run off at the bottom; but in this, Mr. Saville stated, it rose, and overflowed by the pipe G. It might be that the inlet of the liquor-pipe being right opposite the outlet-pipe in the chamber F agitated the tar, and caused it to rise in a manner which it would not do under ordinary circumstances. Unless there was some such cause for it rising, he did not see why it should rise and overflow in this washer in any different manner from any other washer. One thing which struck him was that the action of the apparatus was dependent upon the constant flow of water. For instance, if there was much back-pressure caused by a slowing-down of the exhauster, and this forced the water down in the washing-chamber and over the overflow-pipe, and if at the same time the water supply was stopped, the result would be that, when it righted itself, the combs would be unsealed. This seemed to him to be a little defect in the apparatus, though he quite saw that it would continue only so long as the water supply might be stopped.

Mr. THOMAS DUXBURY (Darwen) said that since the last meeting he had not given the time and attention to the subject under consideration which it deserved. He understood, however, that Mr. Saville had the apparatus in operation at his works at Todmorden; and if so, he took it for granted that he had actually proved that what he said was correct, despite the defect pointed out by Mr. Carr. One of the things which would contribute to its effectiveness would be a constant supply of liquor, which must not stop whatever else came or went. A question might also arise as to the tar being apt to get thick or sticky. Perhaps Mr. Saville would tell them whether the apparatus got clogged or stopped, first, in the supply of liquor, and, secondly, in the tar getting away.

Mr. JOHN CHADWICK (Oldham) stated that he did not hear the paper read; and he was too late for the explanation which Mr. Saville had given that afternoon. If he understood the matter aright, something of a similar kind had occurred to himself; but he could not see what effect this washer had in making it more easy to work an anti-dip on the hydraulic main. It seemed to him that the same pressure would be thrown upon the hydraulic main through the pressure being in the washer, just as if they were working in a dip-pipe. He did not see how it could overcome the pressure which would meet the gas from the inlet-pipe.

Mr. NEILL MEIKLEJOHN (Longwood) said a similar objection occurred to his mind as had been felt by Mr. Chadwick—namely, that they were simply removing the pressure from the hydraulic main to this machine. He did not think, however, that Mr. Saville claimed to remove all the pressure, but to regulate it more exactly. At his works he found that the exhauster was more easily regulated now than when they were working with a seal. If they could set this apparatus to work at a level gauge, and it could work at the atmospheric pressure with the regulator practically never altered, he thought it would be a good machine to use with any form of anti-dip.

Mr. SAVILLE, replying to Mr. Carr, said the reason the tar ran over first was that it must of necessity settle at the bottom, and that was the first thing to be sent off—just in the same way as, if they put water and tar in a pressure-gauge, the tar would be at the bottom, and would be the first to work off.

Mr. CARR said the same principle was applied in the Livesey washer; but it did not act.

Mr. SAVILLE stated that in this machine it did.

Mr. CARR said he wanted to know what would happen if the exhauster slackened speed, causing the combs to be unsealed, and the flow of water was at the same time suspended.

Mr. SAVILLE said, if the exhauster did slacken speed, they found that a sufficient amount of tar was deposited to maintain the pressure. They had had the strap off the pump for two or three hours at a time, and had found no ill-effect from it. At the same time it was desirable to maintain a constant stream of water.

Mr. MEIKLEJOHN: That means that the tar and liquor ordinarily deposited in working keeps it sealed?

Mr. SAVILLE said it did; it very soon made enough. Mr. Chadwick had told them that he could not see where it was better than the anti-dip. At Todmorden they found that, with an old Anderson exhauster, they could not work anti-dip pipes; they could not work fine and exact enough. But with the arrangement he had described, the old exhauster was sufficient. They could set the machine at the atmospheric pressure, and then set the exhauster a little faster—to draw an inch or so. As Mr. Meiklejohn had said, it prevented any variation of pressure from the exhauster. This apparatus was situated by the exhauster; and if the exhauster stopped, it threw no pressure on the retorts.

The PRESIDENT: In that way you get rid of the pressure which is usually caused by the Livesey washer?

Mr. SAVILLE: That is so.

THE SUPPLY OF STEAM TO REGENERATOR FURNACES AND THE UTILIZATION OF WASTE HEAT FOR RAISING THE SAME.

Mr. W. R. Chester (Nottingham) then read his paper on this subject which was given in the JOURNAL for the 9th inst. At its close the following discussion took place:—

The PRESIDENT remarked that they had listened to a very able paper, and it would be as well to discuss it at once.

Mr. T. NEWBIGGING (Manchester) said he thought they would not do justice either to Mr. Chester or his paper if they discussed it that day. No doubt it was disadvantageous to postpone discussions; but he considered the balance of advantage was in favour of postponement, so that they could thoroughly assimulate the important points in any paper, and be able to express themselves usefully in the discussion of it.

The PRESIDENT said he was entirely in the hands of the meeting. They had, however, some time at their disposal that afternoon; while at the next meeting, the President's address, the election of officers, and other matters would occupy a considerable portion of the meeting.

Mr. CHESTER observed that he should prefer the discussion to be taken at once. The next meeting would be the annual one, and past experience had shown that there was on such occasions little time for the discussion of papers. Last year the discussion of a paper read in November did not take place until the following August; and so long a postponement was undesirable, and unsatisfactory both to readers of papers and to the Institution. Personally he did not mind; but it would be much better for them to finish the business, instead of adjourning it to some future day, which was altogether uncertain.

Mr. H. VEEVERS (Dukinfield) supported the suggestion that the discussion should be deferred. The subject of the paper was very important; and as all of them had not regenerative furnaces, it was desirable to adjourn the discussion, in order that they might make inquiries and familiarize themselves with the question.

Mr. T. B. BALL (Rochdale) said he did not see any objection to those who wished to say anything on the paper doing so then, while they had Mr. Chester present. Possibly, if the discussion were adjourned, Mr. Chester would be unable to attend the meeting at which it would come up. He should like a little further enlightenment upon some points in the paper. For instance, with regard to the method pretty generally adopted of using water in the ash-pan, Mr. Chester said: "The vapour, being cool in comparison with the fire, has a direct cooling effect on the bars; but its usefulness as a cooling agency is due in a far greater degree to its action as a diluent of the air—thus rendering combustion in the lower portion of the fire less rapid and fierce." He did not quite follow this; but he had no doubt that Mr. Chester would be able to give them a satisfactory explanation of it. He knew from his own experience, and, of course they all knew, that the refuse from ordinary furnaces contained a very large percentage of combustible matter. He had had a good many analyses made of the refuse from the furnace; and, speaking entirely from memory, he found that it was composed

* The text of the paper, with the illustrations, appeared in the JOURNAL for Sept. 2, p. 496.

of 25 per cent. of water, 25 per cent. of ash, and somewhere about 50 per cent. of combustible matter. For the last twelve months, by the use of Perret's furnaces, they had raised practically all the steam required on the works by the consumption of the refuse ashes. They did not make enough refuse in the summer to keep the boiler supplied; but there was more than enough in the winter, and that which was not required was stored until it could be used in the summer. Mr. Chester gave the economy of fuel in the regenerator settings at 50 per cent., and referred to the price of coke as 12s. per ton. He congratulated him on getting so good a price; but he feared there were many who did not realize more than 75 per cent. of that. Mr. Chester also said there was a saving of 20s. per week on labour; and a total net saving of £7 6s. per bed of retorts per week. This was a point on which he should like to be further informed, because such a sum was a large proportion of the stokers' wages. Then with regard to the supply of steam he wished to know at what part of the furnace the steam was admitted.

Mr. CHESTER: Under the fire-bars.

Mr. BALL said he should have expected that the effect would be that a large portion of the back of the fire would be left exposed, and that the upper portion would have been burned through, and the steam would have been largely decomposed in passing the fire-bars and up through the fire. There would be points which they could no doubt more usefully discuss after reading the paper; but he agreed with Mr. Chester that it was hardly complimentary to contributors of papers to postpone discussions from one meeting to another, with the result that the papers were practically forgotten, and the discussion was neither what the Institution would like, nor what the authors of papers had a right to expect.

The PRESIDENT said he thought they ought to decide whether the paper—which was one of great value—should or should not be discussed at that meeting.

A show of hands was taken; and a majority of the members were in favour of the continuance of the discussion.

Mr. T. O. PATERSON (Birkenhead) said that Mr. Chester had perhaps more experience of regenerator furnaces than most members of the Institution. When in Manchester, he worked them both with and without steam; and the fact that he had had this experience led him (the speaker) to believe that what he had brought before them that day was something in the right direction. At the same time he believed very much depended on the class of coke used, whether or not clinkers would be found in the furnace. He was now working three furnaces on the line of those in use in Manchester. He used 75 per cent. of coal and 25 per cent. of rich cannel; and they only needed to clinker the bars once in twenty-four hours, and then the refuse came away as dust. In his own case, therefore, he did not see that it would be of any advantage to use steam; but different works employed different material, and in some works steam might be necessary. As to the saving of coke in the regenerator furnaces, he could quite corroborate what Mr. Chester said. They were using about 14 lbs. of coke at Birkenhead to 100 lbs. of coal carbonized.

Mr. NEWBIGGING, who was next invited to take part in the discussion, said in justice to Mr. Chester and his paper, they ought to have had an opportunity of perusing the paper by themselves. He repudiated altogether the suggestion that it was any discourtesy to the reader of a paper to postpone the discussion; it was quite the opposite. They could not do justice to the paper by putting a series of fragmentary questions. He did not say this was not useful; but they might ask such questions as occurred to them now, and yet have a proper discussion on the paper at a future time.

Mr. MEIKLEJOHN inquired if members could not be supplied with copies of the papers before the meetings. If this could be done, there would be no necessity for postponing discussions. It was quite impossible to grasp the details of a paper like Mr. Chester's on merely hearing it read. There were tables at the end of it, and a mass of detail, which were no doubt most valuable; but it was absurd to expect them to discuss the subject. They might keep asking questions; but he did not see that they could do anything more.

The PRESIDENT observed that the suggestion of Mr. Meiklejohn could be considered by the Committee; and, if it were found practicable, it could be put in operation. In the meantime, while disclaiming any idea of discourtesy to the reader of the paper, it seemed to him that they might ask questions even if they did not finally close the discussion that day.

Mr. DUXBURY said he did not know that he had had any experience with the method which Mr. Chester had laid before them. He had been trying one or two regenerator settings at Darwen. Before the alterations were made at his works, the retort-bench was not far from the boilers, and at that time they had down-flues from the bench to the chimney, which he diverted under the boiler. For eight months in the year, he thus raised all the steam required for the works by the waste heat going to the chimney. Now, however, the retort-house was 200 or 300 yards away from the boiler; and they would have difficulty in taking steam that distance. He had tried one or two regenerator furnaces without steam, because of the difficulty of raising it; and he was glad Mr. Chester had brought this method before them. He did not quite understand whether the boiler was vertical or horizontal.

Mr. CHESTER: Vertical.

Mr. DUXBURY: Does that mean that the heat passes through the tubes?

Mr. CHESTER: It passes round the tubes, which are suspended from the boiler as it were. It was a water-tube boiler.

Mr. DUXBURY: And the inner tube is loose?

Mr. CHESTER: There is no inner tube; only one tube in which the water circulates.

Mr. DUXBURY, continuing, said that at his works they had a bench in three sections, with two chimneys in the whole line of the bench. On the one side, they had four ovens through; and on the other three through; and the same with the second chimney. Sometimes they worked one section, and sometimes another; so that it would be a question whether they would not have to have four different boilers, or whether they should change the position of the boiler so as to raise steam all round. It seemed to him that they would require four boilers, in order to obtain sufficient steam at all times of the year. With the whole of the works in full operation, there would be no great difficulty; but when one section or another was laid off, they would want boilers in the others to meet this little difficulty. With the regenerator settings which he had laid down, he had tried a jet of water played underneath, and raised steam in this way; but it did not act as well as the steam from the boiler at the old works. He should like to know whether Mr. Chester had tried the method of raising steam from water in the shape of spray played underneath the furnace.

Mr. J. BOOTH (Southport) asked whether Mr. Chester had one boiler to each setting, or how many settings did the one boiler answer for?

Mr. CHESTER replied that he had one boiler for a retort-house of sixteen settings. It was placed on one side of the chimney; but he contemplated next year putting one on the other side, and so have two boilers for the sixteen settings. The steam generated by the one boiler was more than sufficient for the number of settings from which it received the waste heat. Eight settings supplied the heat to the boiler which he had; and it furnished steam to twelve settings. When they had two boilers next year, one would be used or not as might be required.

Mr. BOOTH said there was no doubt that, if by the means described they could avoid the formation of clinker, it would be very satisfactory indeed. At his works, they could not get down a sufficient depth to build full generator furnaces; but for some months he had had the steam-boiler connected with two furnaces, and at present it answered very well. He was continuing the experiment in other beds of retorts; and if it proved as successful as to the first two, he proposed to adapt it to all the other settings.

Mr. CARR said he had seen Mr. Chester's furnaces at work at Nottingham; and that gentleman was kind enough to permit him to erect some on the same principle at Widnes. This had given him an opportunity of testing the virtue of steam as against water in generator furnaces. He had realized very good results—nothing like those obtained by Mr. Chester; but very much better than anything he had been able to get before with any kind of setting. There was a great deal of valuable data in the paper which would be of great assistance to them in calculating how they stood with regard to the consumption of fuel. Respecting Mr. Paterson's remark, that water softened the clinker, he had never heard it before. He had tried water in almost every conceivable form, and to all kinds of coal, and he never found it softened the clinker to any appreciable extent; there was always fusion where there was water. Still it was a matter worth inquiring into, because steam cost money, and required some attention; and if the results could be produced without steam, they ought to find out how it could be done, and do it. The value of steam under the furnace was proved by the stokers. If the steam was from any cause shut off for any length of time, there were loud complaints from the retort-house. The men had to go down into a rather unpleasant place to see to the furnaces; and if the steam had been shut off for a little while, fusion took place, and their work was very hard. If the steam was continued, they had simply to go and rake down the ash, which was not so clear as the sample produced by Mr. Chester; but still it was not soft, and contained very little combustible material. They could not produce at Widnes the same results as Mr. Chester, because they used coal of very much lower quality. It was the lowest quality of coal raised in the Widnes district, and some of the coke contained 25 per cent. of ash; and so long as this coal was used, they must have very much worse results than Mr. Chester had set forth. With reference to the principle of adjourning discussions, whilst he believed it had its advantages, it was nevertheless a fact, which must have been patent to everybody at the last meeting, and at the opening of the present one, that adjournments had proved a great mistake. They left the meeting with the best intentions as to reading the papers, and coming prepared to discuss them; but, as a matter of fact, they did not do it. But from the accident that he had to wait for a train that morning, and spent the time in looking over Mr. Saville's paper, he should (like the majority of those present) have had nothing to say upon it. It was a poor compliment to gentlemen who wrote papers to have such discussions as they had at the last meeting on Mr. Newbigging's paper, or as they had at the present meeting on the paper by Mr. Saville.

Mr. SAVILLE inquired how long the boiler Mr. Chester referred

to had been in use, and expressed the opinion that the wear and tear must be very great.

Mr. CHESTER said the boiler had been in use two months.

Mr. DUXBURY pointed out that Mr. Chester gave the diameter, but not the length of the boiler.

Mr. CHESTER: It is about 8 feet.

The PRESIDENT remarked that at Barnsley, for the last two or three years, they had raised the whole of the steam required on the works by the waste heat from two settings of retorts; and so far as that went, it had been an economy, though he quite recognized the value of Mr. Chester's improved setting. In his opinion, much more could be done in gas-works in the utilization of waste heat for raising steam; and if they could attain to the complete combustion which Mr. Chester had, as proved by the sample of ash produced, they would derive great advantage.

Mr. CHESTER, replying to the various questions, said the principal object he had in bringing the question before the Institution was to emphasize the fact as much as possible that, by a judicious arrangement in the steam supply and in the construction of furnaces, it was possible to produce a refuse from the combustion of coke of such a character that it practically required no more labour in abstracting it from the fire than shovelling it into a barrow and wheeling it away. This was the object he had aimed at in his experiments; and he ventured to think he had attained considerable success. The coke was cannel coke, and contained, as was shown by laboratory experiments, about 10 per cent. of ash. The ash in the bottle, to which some of the speakers had referred, was taken in a shovel from one of the furnaces before he came away. The quantity of combustible matter which came from these furnaces was an exceedingly small percentage. It was just that which fell with the ash from the fire itself. In clearing the fire, they placed a number of horizontal bars through the fire at a certain point, and then took out the lower bars, and allowed the ash to fall down. If the bars were pushed too far into the fire, a little carbon fell with the ash; but it was a very small proportion of the total. Mr. Ball did not quite understand what he meant by the steam acting as a diluent of the air supplied to the furnace. He simply meant that there was a certain amount of chimney draught on the furnaces; and as the water vaporized, it took the place of a certain amount of air which would go into the furnace if water was not there, and to that extent it displaced the air, and acted as a cooling medium on the bars. Mr. Ball told him that he used the cinders from his ovens for the purpose of generating steam. That was an economical arrangement as far as it went; but it would be very much better to leave them in the furnace and let them generate heat for the settings. As to the question of saving labour. In Manchester a man looked after five fires. But these furnaces only required attention once in twenty-four hours, except periodical firing; and the consequence was that, instead of three men to five furnaces, they needed only one man to 5⅓ furnaces—that was to say, they had the three men for the 16 furnaces in twenty-four hours. This was rather more than the proper amount of work for a fireman; but these three men, one on each of the eight-hour shifts, did the whole of the work. The cost in Manchester was 5¼d. per ton of coal carbonized; while in his case, with regenerator furnaces, it was something under 2d.

Mr. BALL: But you say that one man takes five furnaces in Manchester; and that in Nottingham there are three men for sixteen furnaces. Where is the saving?

Mr. CHESTER replied that the difference was in the quantity of coal carbonized. Mr. Paterson said the formation of clinkers no doubt depended on the character of the ash contained in the fuel. It was so to a very large extent; and fuel having a large percentage of ash should receive a greater percentage of steam than that containing less. The combustion would be more fierce at the bottom; and therefore it would require a larger proportion of steam in order to keep down the temperature, so that the ash must not be fused. Mr. Paterson did not see the advantage of using steam. The fact was, however, that if steam was raised by some such means as that which he (Mr. Chester) had advocated, it cost nothing; and they could use it in any proportion without increasing the cost of the fuel. The heat which it abstracted from the setting was given back by the combustion of the hydrogen; and it enabled them to work the furnace at a lower temperature, and thereby increased their durability. Mr. Duxbury asked if it would be essential to have four boilers in his arrangement of a retort-house. That was not at all necessary. The setting down of beds was generally arranged to suit repairs; and in large works they were let down in batches. If one out of four were let down, the boiler would still generate sufficient steam to supply requirements. In a case like Mr. Duxbury's, he should put down a boiler for eight or nine settings; and the supply of steam would then be ample, whether a portion of the retorts were let down or not. The spray of water which Mr. Duxbury referred to would no doubt have the effect of damping the coke with which it came in contact, and prevent the portion of it on which the spray played from being completely consumed; and as the ash or clinkers fell out, this portion of the fuel would drop down with it, and be wasted. The great advantage of steam was that it passed over the whole surface of the fire, and mingled with the coke until it enabled the whole of the lower part of the fuel to be completely consumed, while the top portion was kept in a state of only partial combustion. Mr. Carr said he always found that, where water was used, a fusion of the ash took place. He (Mr. Chester) thought that this followed. The water spray, in playing over the lower portion of the fuel was converted into steam; and while this steam was of advantage above, the water was very disadvantageous to the lower part of the fire, and there was probably not sufficient steam generated to prevent the formation of clinker. Mr. Saville believed the wear and tear would be very great. He did not care if it was. They had a saving in fuel equal to three guineas a week; and they could afford to renew the boiler twice a year if necessary. His idea was that, as the tubes were continually supplied with water, and constantly generating steam, and as the heat was very uniform, there would not be much wear and tear. At the same time he intended to lift the boiler out of its position at the end of the season in order to examine it.

Mr. MEIKLEJOHN: Three guineas a week on how many beds?

Mr. CHESTER: Twelve beds of retorts. The steam used to cost three guineas per week; and now it costs nothing. He had hoped that, in touching upon the question of regenerative furnaces, he should have introduced a topic of great interest to many of the members; and he had ventured to hope they would have had a very strong discussion upon the subject. He was pleased to hear the remarks of some of the gentlemen who had spoken; but he was a little disappointed they had not had a more vigorous debate.

The PRESIDENT moved a vote of thanks to Mr. Chester for his paper, which he was sure would be of very great advantage to those responsible for the management of gas-works.

Mr. VEEVERS, in seconding the proposition, said the paper was valuable and interesting; and, as he had previously observed, was worth the serious attention of the members of the Institution. He believed he was the first engineer to use regenerator furnaces in the neighbourhood of Manchester; and he should have liked time to have made inquiries before discussing the paper.

Mr. DUXBURY supported the motion, and said that, as one largely interested in the subject of the paper, he should take the first opportunity of going to Nottingham to look at Mr. Chester's apparatus, with a view to adopting it, or some other equally effective method.

The motion was unanimously passed; and it was briefly acknowledged by Mr. Chester.

THE FORCES REQUIRED TO RESIST WIND PRESSURE ON A GAS-HOLDER GUIDED FROM THE BASE.

Mr. W. Gadd (Manchester) then gave a physical demonstration, by the aid of cardboard models and illustrations, of the effect of various strains of the force required to resist wind pressure on a gasholder guided from the base. His remarks on the subject were published a fortnight ago; and the following is a report of the observations which were subsequently made by members:—

The PRESIDENT said he thought that, as it was contended it would be no injustice to Mr. Chester to postpone discussion on his paper, it would be no injustice to Mr. Gadd to put off the discussion of his paper to the next meeting.

Mr. NEWBIGGING remarked that he did not know that this was a more difficult subject to discuss than the other. The question of regenerator furnaces was one of experience and working data; but as to the demonstration which Mr. Gadd had given them, there could be no question whatever if they understood it. They must all be exceedingly obliged to Mr. Gadd for the trouble he had taken to put the demonstration before them; for it must have taken him a very considerable time to prepare. He only wished that, in addressing them, Mr. Gadd had had less of a mathematical mind. It would have been well if he had explained at the outset, that the force which he called "x" on one side of the model represented the force of the wind pressing on the opposite side of the holder, and that the other forces attached to the opposite side represented the resisting forces. However, if they studied it, he was sure they would see that it was a clear demonstration upon scientific principles of resistance to strains whether upon a gasholder, a roof, or any other building which had a fixed base. Personally he was much obliged to Mr. Gadd for supplementing in this way the paper which he read at The Gas Institute meeting at Ryde. It was bad when doctors disagreed, and he had felt sorry to read the somewhat personal and acrimonious discussion which had taken place in the JOURNAL OF GAS LIGHTING between Mr. Cripps and Mr. Gadd. From his long acquaintance with Mr. Gadd, he was convinced that it was absurd of Mr. Cripps or anyone else to presume to say Mr. Gadd did not understand the question. He knew that Mr. Gadd did understand the question; and he thought the members who had witnessed his demonstration would come to the same conclusion. The letter which appeared in the last issue of the JOURNAL was one which, in his opinion, a gentleman should not have written. It was not fair to give the opinion of outsiders, whose opinions might be worth nothing. If they had had the names, they might have thought more about the opinions expressed. Furthermore, it was not fair to suggest in a letter that the writer of it could say a good deal more if he considered it necessary. If he had more to say, he ought to say it, and let them have the whole of it, and not vaguely suggest there was something very much more behind

which he could let out if he liked. All this was very unfair; and therefore he said that the last letter was one which a gentleman should not have written. He begged to move that their very best thanks be given to Mr. Gadd for the trouble he had taken in bringing his demonstration before them. Whatever might be said about this method of guiding gasholders, nothing could ever detract from the originality and beauty of the idea. It was so perfectly original, and certainly so far it had been a success, and had stood very severe storms.

Mr. R. HALL (Matlock) said he should also like to refer to the statement of Mr. Cripps, that he could say a great deal more if he would. When he saw the remark, he confessed he did not like it; it left an uncomfortable feeling which ought not to have been created without evidence to support it. Proceeding, he said that during the last few weeks they had had a holder put up at Matlock on the principle invented by Mr. Gadd. This holder was the second of its kind in the kingdom (the one at Northwich being the first); and, so far as it had gone, the holder had worked admirably. It had had to stand some pretty stiff strains; and it worked as easily as a holder could do. He believed this testimony was the finest which could be given to the value of the idea that Mr. Gadd had introduced.

Mr. MEIKLEJOHN said he did not think it mattered very much to them what Mr. Cripps had said, or what had passed in the discussion between him and Mr. Gadd. This was altogether outside their jurisdiction. He had no doubt that if either Mr. Newbigging or Mr. Hall entered into a discussion with Mr. Cripps, he would be found able to defend himself; but in the meantime it was hardly fair to criticize him in his absence. They were very much obliged to Mr. Gadd for his paper; but he should have been glad if it had been more free from mathematical statements. His last demonstration was very plain—that equal force acting at equal distances would have equal resistances; but it struck him that, if "x" represented the total wind pressure on the side of the holder, Mr. Gadd's argument went to prove that "$\frac{1}{2}x$" vertical pressure from the centre to the end of the holder was sufficient to resist this. If Mr. Gadd had explained that "x" represented the wind pressure, and that the other strains were the resistances of the bottom guide-rollers, it would have been more clear.

Mr. BALL seconded the vote of thanks to Mr. Gadd. He agreed with Mr. Meiklejohn that, if Mr. Gadd had disregarded the correspondence which had been going on between himself and Mr. Cripps, and had started from the assumption that the members did not know anything about it, they would perhaps have got a little clearer idea of what he was showing them.

The PRESIDENT supported the motion, and said he thought they could thoroughly rely upon Mr. Gadd's statements as to the resisting powers of his holder. He brought his invention before the Institution originally; and they had taken an interest in it. Still he should be very sorry if a covert attack were made upon Mr. Cripps through the medium of the Institution; and he did not think that was intended. Mr. Gadd and Mr. Cripps could settle their differences elsewhere.

The resolution was carried.

Mr. GADD, having apologized for using mathematical terms which had rendered his demonstration less clear than it might have been, said his only object in appearing before the Institution was to demonstrate physically what he had said previously; and as two of the members had had to deal with holders put up according to his invention, he considered they ought to have proof that what he said was true. He had no doubt about the matter himself; but he thought it only proper and right that he should come and tell them that his opinion was just the same as it was originally. He tried to avoid as much as possible reference to the controversy which had been going on; but be wanted them to recognize the fact that there was no real difference between himself and Mr. Cripps—that in one case one triangle was employed for the measurement of the strains, and in the other case another triangle was used which was the identical mathematical equivalent of the first. He felt no ill-will to any of his critics. He believed in criticism; for a thing which was not worth criticism was not worth much. Mr. Newbigging had designed the holders at Northwich and Matlock to carry the strains which had been set forth mathematically. When he referred to "x" as a pressure, he spoke of it as a wind force—the total wind force acting upon the structure. All the strains contained in the holder must centre themselves in a neutral centre. It was perfectly true the vertical force only operated at the corner; but, as this demonstrated, the horizontal force was increased, so that the one took the place of the other. This was the explanation of the conclusion that was come to, that the chief horizontal strain came upon the middle rollers, not because the middle rollers became a neutral point, but because the strain was resolved in that direction.

LIME BURNING.

Mr. Newbigging then read his paper on the subject of lime burning, given in the JOURNAL for the 9th inst. At its conclusion,

Mr. VEEVERS, in moving a vote of thanks to the author, said he regretted he had not touched upon the use of coke in lime burning. He encouraged this while at Bolton, and sent thousands of tons of coke to the neighbourhood of Clitheroe for the purpose of being used in the lime-kilns.

Mr. C. WOOD (Bradford) seconded the resolution, which was carried; and the business concluded.

GASEOUS ILLUMINANTS.

Professor VIVIAN B. LEWES, F.I.C., F.C.S., gave the fourth of his series of lectures on the above subject at the Society of Arts on Monday last week; taking up the question of enriching ordinary gas by means of carburetted water gas.

The lecturer began by referring to the remark made by Mr. Frank Livesey, in the paper read by him at the last meeting of the Southern District Association of Gas Engineers and Managers (*ante*, p. 1041), to the effect that the Maxim-Clark process of carburetting gas, described in the previous lecture, "should in many cases take the place of cannel," but that it would probably be "replaced in its turn by a water gas of 20 to 25 candle power;" and he then proceeded to describe the various appliances for producing this "probable cannel of the future." Briefly sketching the history of this illuminating agent, he said that, discovered by Fontana in 1780, and first worked by Ibbetson in England in 1824, water gas had added a voluminous chapter to the patent records of England, France, and America; as between 1824 and 1858 no less than 60 patents were taken out in which the action of steam on incandescent carbon was the basis for the production of an inflammable gas. Up to the latter date, all attempts to make and utilize water gas were failures. About this time, however, the subject began to be taken up in America; and the principle of the regenerator enunciated by Siemens in 1856 having been pressed into service in the water-gas generator, under the name of "fixing chambers" or "superheaters," water gas gradually approached the successful development to which it has attained in the States during the past ten years. Having now, by the aid of American skill, been converted into a practical form, it is once more attempting to gain a foothold in Western Europe, the land of its birth.

Professor Lewes then described the nature of water gas, and the method of generating it. He explained that, when carbon is acted upon at high temperatures by steam, the first action that takes place is the decomposition of the water vapour; the hydrogen being liberated, while the oxygen unites with the carbon to form carbon dioxide, thus:

Carbon.		Water.		Carbon Dioxide.		Hydrogen.
C	+	$2(H_2O)$	=	CO_2	+	$2H_2$

The carbon dioxide so produced interacts with more red-hot carbon, forming the lower oxide, carbon monoxide, thus:

$$CO_2 + C = 2CO$$

So that the completed reaction may be looked upon as yielding a mixture of equal volumes of hydrogen and carbon monoxide—both of them inflammable, but with non-luminous flames. This decomposition, however, is rarely completed, and a certain proportion of carbon dioxide is invariably to be found in the water gas, which, in practice, generally consists of a mixture of about the following composition:—

Hydrogen	48·31
Carbon monoxide	35·93
Carbon dioxide	4·25
Nitrogen	8·75
Methane	1·05
Sulphuretted hydrogen	1·20
Oxygen	0·51
	100·00

The above is an analysis of water gas made from gas coke in a Van Steenbergh apparatus. The ratio of carbon monoxide and carbon dioxide present depends entirely upon the temperature of the generator and the kind of carbonaceous matter employed. With a hard, dense anthracite coal, for instance, it is quite possible to attain a temperature at which there is practically no carbon dioxide produced; while with an ordinary form of generator, and a loose fuel like coke, a large proportion is generally to be found. The sulphuretted hydrogen in the analysis quoted is, of course, due to the high amount of sulphur to be found in the gas coke, and is practically absent from water gas made with anthracite. The nitrogen is due to the method of manufacture; the coke being, in the first instance, raised to incandescence by an air-blast, which leaves the generator and pipes full of a mixture of nitrogen and carbon monoxide (producer gas), which is carried over by the first portions of water gas into the holder. The gas so made has no photometric value—its constituents being perfectly non-luminous; and attempts to use it as an illuminant have all taken the form of incandescent burners, in which thin "mantles" or "combs" of highly refractory metallic oxides are heated up to incandescence. In the case of carburetted water gas, the gas is only used as a carrier of illuminating hydrocarbon gases made by decomposing various grades of hydrocarbon oils into permanent gases by heat.

With regard to the manufacture of water gas, the lecturer said that many forms of generators had been used in the United States for the production of the gas, which, either after or during the process, is mixed with the vapours and permanent gases obtained by cracking various grades of paraffin oil, and "fixing" them by subjecting them to a high temperature. In considering the subject of enriching coal gas by carburetted water gas, he said he should be forced, by the limited time at his disposal, to confine himself to the most successful of these processes, or those which are already undergoing trial in this country. In considering them, he found that they could be divided into two

classes: (1) Continuous processes, in which the heat necessary to bring about the interaction of the carbon and the steam is obtained by performing the operation in retorts externally heated in a furnace. (2) Intermittent processes, in which the carbon is first heated to incandescence by an air-blast, and then, the air-blast being cut off, superheated steam is blown in until the temperature is reduced to a point at which the carbon begins to fail in its action, when the air is again admitted to bring the fuel up to the required temperature; the process consisting of the alternate formation of producer gas with rise of temperature, and of water gas with lowering of temperature.

Of the first class of generator, none, as far as the lecturer knew, have as yet been practically successful in England; the nearest approach to this system being the Meeze, in which fire-clay retorts, in an ordinary setting, are employed. In the centre of each retort is a pipe leading nearly to the rear end of the retort, and containing baffle-plates. Through this a jet of superheated steam and hydrocarbon vapour is injected; and the mixture passes the length of the inner tube, and then back through the retort itself (which is also fitted with baffle-plates) to the front of the retort, when the fixed gases escape by the stand-pipe to the hydraulic main. The rich gas thus formed is used either to enrich coal gas, or else is mixed with water gas made in a separate generator. In some cases, the water gas is passed with the oil through the retort. In such a process, the complete breaking down of some of the heavy hydrocarbons takes place; and the superheated steam, acting on the carbon so liberated, forms water gas, which bears the lower hydrocarbons formed with it. But inasmuch as oil is not an economical source of carbon for the production of water gas, this would probably make the cost of production higher than necessary. This system has been extensively tried, and indeed used to a certain extent; but the results have not been altogether satisfactory—choking of retorts being one of the troubles which have had to be contended with.

Of the intermittent processes, the one most in use in America is the Lowe, in which the coke or anthracite is heated to incandescence, by an air-blast in a generator lined with fire-brick; the heated products of combustion, as they leave the generator and enter the superheaters, being supplied with more air, which causes the combustion of the carbon monoxide present in the producer gas, and heats up the fire-brick baffles with which the superheaters are filled. When the necessary temperature of fuel and superheater has been reached, the air-blasts are cut off, and steam is blown through the generator, forming water gas, which meets the enriching oil at the top of the first superheater, called the "carburetter," and carries the vapours with it through the main superheater, where the firing of the hydrocarbons takes place. The chief advantage of this apparatus is that the enormous superheating space enables a lower temperature to be used for the fixing, which does away to a certain extent with the too great breaking down of the hydrocarbon, and consequent deposition of carbon. This form of apparatus has lately found its way to this country; and the lecturer described it as being the one most used in the United States, and the type upon which practically all water gas plants with superheaters have been formed.

The Springer apparatus, which is now under trial by a large gas company, differs from the Lowe only in construction. In the former the superheater is directly above the generator; and there is only one superheating chamber instead of two. The air-blast is admitted at the bottom, and the producer gases heat the superheater in the usual way; and when the required temperature is reached, the steam is blown in at the top of the generator, and is made to pass down through the incandescent fuel. The water gas is led from the bottom of the apparatus to the top, where it enters at the summit of the superheater, meets the oil, and passes down with it through the chamber; the finished gas escaping at the middle of the apparatus. This idea of making the air-blast pass up through the fuel, while in the subsequent operation the steam passes down through it, is also to be found in the Loomis plant, and is considered by Professor Lewes to be a distinct advantage—the fuel being at its hottest where the blast has entered; and, in order to keep down the percentage of carbon dioxide, it is important that the fuel through which the water gas last passes should be as hot as possible, to ensure its reduction to carbon monoxide.

The Flannery apparatus is also only a slight modification of the Lowe plant; the chief difference being that, as the water gas leaves the generator, the oil is fed into it, and with the gas passes through a ⌂-shaped retort tube, arranged round three sides of the top of the generator. In this tube the oil is volatilized, and passes with the gas to the bottom of the superheater, in which the vapours are converted into permanent gases.

The Van Steenbergh plant (with which, as our readers may remember, Professor Lewes has been experimenting for some time) stands apart from all other forms of carburetted water gas plant, in that the upper layer of the fuel itself forms the superheater, and that no second part of any kind is needed for the fixation of the hydrocarbons. This arrangement reduces the apparatus to the simplest form, and leaves no part of it which can choke or get out of order—an advantage which will not be under-rated by anyone who has had experience of these plants. While, however, an enormous advantage is gained, there is also the drawback that the apparatus is not at all fitted for use with crude oils of heavy specific gravity, such as can be dealt with in the big external superheaters of the Lowe class of water-gas plant, but requires to have the lighter oils used in it for carburetting purposes. The lecturer said he was not sure that this, which appeared at first sight to be a disadvantage, was altogether one, as, in the first place, the lighter grade of oils, if judged by the amount of carburetting property they possess, are cheaper per candle power added to the gas than the crude oils; while their use entirely does away with the formation of pitch and carbon in the pipes and purifying apparatus—a factor of the greatest importance to the gas manufacturers. The fact that light oils give a higher carburation per gallon than heavy crude oils is due to the fact that the crude oils have to be heated to a higher temperature to convert them into permanent gases; and this causes an over-cracking of the most valuable illuminating constituents. This trouble cannot be avoided; as, if a lower temperature is employed, the result is the formation of non-permanent vapours, which, by their condensation in the pipes, give rise to endless trouble. The simplicity of the apparatus is a factor which is a considerable saving of time and expense, as it reduces to a minimum the risk of stoppages for repairs; while the initial cost of the apparatus is necessarily low, and the expense of keeping it in order practically *nil*.

Speaking of his personal experience with the Van Steenbergh apparatus, Professor Lewes said: When I first made the acquaintance of this form of plant a year ago, the promoters were confident that nothing could be used in it but American anthracite of the kind they had been in the habit of using in America, and a light naphtha of about ·689 specific gravity, known commercially as 76° Beaumé. A few weeks' work with the apparatus, however, quickly showed that, with a slightly increased blow, and a rather higher column of fuel, gas coke could be used just as well as anthracite; and that, by increasing the column of fuel, a lower grade of oil could be employed. So that, during a considerable portion of the experimental work, nothing but gas coke, from the Horseferry Road works, and a petroleum of a specific gravity of about ·709, was employed. Having had control of the apparatus for several months, and, with the aid of a reliable assistant, having checked everything that went in and came out of the generator, I am in a position to authoritatively state that, using ordinary gas coke and a petroleum having a specific gravity ranging from ·689 to ·709, 1000 cubic feet of gas having an illuminating power of 22 candles can be made with an expenditure of 28 to 30 lbs. of coke and 2½ gallons of petroleum. The two most important factors—*i.e.*, the quantity of petroleum and the illuminating value of the gas—were also checked and corroborated by Mr. Charles Heisch and Mr. Leicester Greville. I must admit that these results far exceeded my expectations, although they only confirmed the figures claimed by the patentee; and there are not wanting indications that, when worked on a large scale and continuously, they might be even still further lowered. It is impossible to obtain the most economical results when making less than 10,000 cubic feet of the gas, as the proper temperature of the walls of the generator are not obtained until after several makes; and it is only after about 8000 cubic feet of gas have been produced, that the best conditions are fulfilled. It will enable a sounder judgment to be formed of the working of the process if the complete experimental figures for a make of gas are taken. These are as follows:—

Production of the Gas.

Total gas made = 8700 cubic feet.

Time occupied	Blowing	60 minutes.
	Making	50 "
Fuel used	Gas coke	270 lbs. = 31 lbs. per 1000 cubic feet.
	Naphtha (sp. gr. ·709)	24 galls. = 2·7 galls. " "
Illuminating power of gas.		21·9 candles.

Composition of the Gas.

Hydrogen	46·75
Olefines	7·59
Ethane	6·82
Methane	11·27
Carbon monoxide	18·95
Carbon dioxide	0·50
Oxygen	0·17
Nitrogen	8·25
	100·00

Unpurified Gas.

Carbon dioxide	2·32 per cent.
Sulphuretted hydrogen	2·84 "
Total sulphur (by Letheby apparatus)	6·67 grs. per 100 c.f.
Ammonia	nil.
Bisulphide of carbon	nil.

Stages of Gas Production.

	Cub. Ft.	Gals.	Pts.
1st make produced	3600; naphtha used,	10	7
2nd " "	2800 " "	7	6
3rd " "	2300 " "	5	3
Total production, 8700; total naphtha,		24	0

The last portion of the above table shows the economy which arises as the whole apparatus becomes properly heated. Thus the first make of gas used 3 gallons of naphtha per 1000 cubic feet of gas; the second, 2 gallons 6 pints; the third, 2 gallons 4 pints. It is therefore not unreasonable to suppose that, in a continuous make, these figures could be kept up, if not actually reduced still lower. In introducing the oil, it is not injected, but is simply allowed to flow in by gravity at a point about half way up the column of the fuel; the taps for its admission being placed at intervals round the circumference of the generator.

The oil at first begins to flow down the inside wall of the generator; but, being vaporized by the heat, the vapour is borne up by the rush of steam and water gas, and is cracked to a permanent gas in the upper layer of fuel. This, I think, is the secret of not being able to use heavier grades of oil; they being sufficiently non-volatile to trickle down the side into the fire-box at the bottom, and so to escape volatilization. I have tried to steam-inject the oil; but have not found that it yields any better results. One of the first things which strikes anyone on seeing a make of gas by this system is the enormous rapidity of generation. Mr. Leicester Greville, who is Chemist to the Commercial Gas Company, reporting on the process, says: "The make of gas was at the rate of about 86,000 cubic feet in 24 hours—a remarkable result, taking into consideration the size of the apparatus." It is quite possible with the small apparatus to make 100,000 cubic feet in 24 hours; indeed, the run for which the figures are given showed more than this estimate. It must be borne in mind that this rapidity of make gives the gas manager complete control over any such sudden strains as result from fog or other unexpected demands on the gas-producing power of his works; while a still more important point is that it does away with the obligation to keep an enormous bulk of gas ready to meet such an emergency, and so renders unnecessary the gigantic gasholders which add so much to the expense of gas-works, and take up so much room.

The lecturer next passed on to deal with the objections raised to water gas. He said that perhaps the greatest was to the dread of its poisonous properties, and to the carbon monoxide it contains; but he thought that if we considered the evidence we possess on the increase of accidents due to this cause, we should be struck with the poor case which the opponents of water gas are able to make out. Of course, no one can for a moment doubt the fact that carbon monoxide is one of the deadliest of poisons. It acts by diffusing itself through the air-cells of the lungs, and forming with the colouring of the blood corpuscles a definite compound, which prevents them carrying on their normal function of taking up oxygen and distributing it throughout the body, and at once stops life. All researches on this subject point to the fact that something less than 1 per cent. only of carbon monoxide in air renders it fatal to animal life; and this at first sight seems to be an insuperable objection to the use of water gas. It has, indeed, influenced the authorities in several towns—notably Paris—to forbid the introduction of water gas for domestic consumption. It would be well, however, to carefully examine the subject, and see, by the aid of actual figures, what the risk amounts to, compared with the risks of ordinary coal gas. Many experiments have been made with the view of determining the percentage of carbon monoxide in air which is fatal to human or rather to animal life; the most reliable, as well as the latest results being those obtained by Dr. Stevenson of Guy's Hospital, after an investigation instituted in consequence of two deaths which took place at the Leeds Forge, from inhaling uncarburetted water gas containing 40 per cent. of carbon monoxide. Dr. Stevenson found that 1 per cent. visibly affected a mouse in 1½ minutes, and killed it in an hour and three-quarters; while 0·1 per cent. was highly injurious. Taking, for the sake of argument, the last figure as being a fatal quantity, so as to be well within the mark, Professor Lewes said that, in ordinary carburetted water gas, as supplied by the superheater processes, such as the Lowe, Springer, and others, the usual amount of carbon monoxide is 26 per cent.; but in the Van Steenbergh gas, for certain chemical reasons to be discussed later on, it is generally about 18 per cent., and rarely rises to 20 per cent. An ordinary bedroom is 12 ft. by 15 ft. and 10 ft. high; and therefore it will contain 1800 cubic feet of air. Such a room would be lighted by a single ordinary batswing burner, consuming not more than 4 cubic feet of gas per hour. Supposing the occupant of the room were to retire to bed in such a condition of mental abberation that he preferred to blow out the gas rather than take the ordinary course of turning it off, in one hour the 1800 cubic feet of air would be mixed with four-fifths of a cubic foot of carbon monoxide (the carburetted water gas being supposed to contain 20 per cent.), or 0·04 per cent. In such a room, however, if the doors and windows were absolutely air-tight, and there were no fire-place, diffusion through the walls would change the entire air once in an hour. Therefore the percentage would not rise above 0·04; while in any ordinary room, imperfect workmanship and an open chimney would change it four times in the hour, and reduce the percentage to 0·01—a quantity which the most inveterate enemy of water gas could not claim would do more than produce a bad headache. The point under consideration, however, was the use of carburetted water gas as an enricher of coal gas, and not as an illuminant to be consumed *per se*; and it might be calculated that it would be probably used to enrich a 16-candle coal gas up to 17·5-candle power. To do this, 25 per cent. of 22-candle power carburetted water gas would have to be mixed with it; Taking the quantity of carbon monoxide in London gas at 5 per cent. (a very fair average figure), and 18 per cent. as the amount present in the Van Steenbergh gas, we have 8·25 per cent. of carbon monoxide in the gas as sent out—a percentage hardly exceeding that which is found in the rich cannel gas supplied to such places as Glasgow, where it is not found that an unusual number of deaths occur from carbon monoxide poisoning. The carburetted water gas has a smell every bit as strong as coal gas; and a leak would be detected with equal facility by the nose. Consequently, Professor Lewes thought his hearers would agree with him that the cry raised against the use of carburetted water gas for this reason was one of the same character that hampered the introduction of coal gas at the commencement of the century.

The lecturer next considered the chemical actions which take place in the generator of the water gas plant; and these, he said, were more complex in the case of the Van Steenbergh plant than in those of the Lowe type, and, for this reason, yielded a gas of more satisfactory composition. Taking gas as made by the Lowe or Springer process, and contrasting it with the Van Steenbergh gas several marked differences are shown—

	Lowe Gas.		Van Steenbergh Gas
Hydrogen	27·14	..	46·75
Marsh gas	25·35	..	11·27
Carbon monoxide	26·84	..	18·65
Illuminants	14·63	..	7·59
Ethane	—	..	6·82
Carbon dioxide	3·02	..	0·50
Oxygen	0·15	..	0·17
Nitrogen	2·87	..	8·25
	100·00		100·00

In the first place, the hydrogen is far higher, and the marsh gas or methane lower, in the Van Steenbergh than in the Lowe process; this being due to the sharper cracking which takes place in the short column of cherry-red coke as compared with the lower temperature employed for a longer space of time in the Lowe superheater. Next, a difference of nearly 10 per cent. is noticeable in the carbon monoxide, which is greatly reduced in the Van Steenbergh generator by the carbon monoxide and members of the marsh gas series reacting on each other as they pass over the red-hot surface of coke, with formation of acetylene, which adds to the illuminants; this action also reducing the quantity of marsh gas present. In the illuminants, if the higher members of the methane series present are added to the olefines, it will be found they are about equal in each gas; while the low percentage of nitrogen in the Lowe gas is due to more careful working, and could easily be attained with the Van Steenbergh plant, by allowing the first portion of the water gas to wash out the producer, before the hopper at the top was closed. The cracking of the naphtha by the red-hot coke is undoubtedly a great advantage; for, as Professor Lewes pointed out for the first time, the cracking of the hydrocarbons of the marsh gas series is an exothermic reaction, so that the coke at the top of the generator becomes gradually hotter. It is no unusual thing to see the coke at the beginning of the make cherry-red at the bottom, and dull-red at the top; while at the end of the make, it is almost black at the bottom, and cherry-red at the top. In this way the same advantage in working is attained that Springer and Loomis afford by their down blast—that is, having the fuel at its hottest where the gas finally leaves it, so as to reduce the quantity of carbon dioxide, and thus lessen the expense of purification.

Turning for a few moments to the gas obtained by cracking the light potroleum oils by themselves, Professor Lewes remarked that the Russian and American petroleum differed so widely in composition, that it was necessary to see in what way the gases obtained from them differed. To do this, equal quantities of an American and a Russian oil were cracked by being passed through an iron tube filled with coke, and in each case heated to a cherry-red heat. The gases were measured, and then analyzed, with the following results:—

	American.		Russian.
No. of cubic feet per gallon	79	..	104
Hydrogen	26·0	..	45·3
Methane	41·6	..	22·3
Ethane	12·5	..	13·9
Olefines	14·1	..	11·6
Carbon monoxide	3·3	..	3·5
Carbon dioxide	1·7	..	2·3
Oxygen	0·8	..	1·1
Nitrogen	nil.	..	nil.
	100·0		100·0

These figures show that, if the Russian oil is a little lower in illuminants, it quite makes up by extra volume; but it seemed to Professor Lewes to deposit a rather larger proportion of carbon. Taking 2·5 gallons of American naphtha, it would give, roughly, 180 cubic feet of gas of the above composition; while the remaining gas would be the ordinary water gas. Taking the analysis of this as given, and calculating from it what would be the composition of a mixture of it with the naphtha gas, we obtain the following results:—

	Calculated.		Actual.
Hydrogen	47·09	..	42·09
Methane	5·48	..	11·27
Olefines	2·53	..	7·59
Ethane	2·17	..	6·82
Carbon monoxide	30·07	..	18·65
Carbon dioxide	3·78	..	2·32
Oxygen	0·56	..	0·17
Nitrogen	7·17	..	8·25
Sulphuretted hydrogen	1·15	..	2·84
	100·00		100·00

These figures prove how great is the effect of the diluents in the water gas in preventing the over-cracking of the hydrocarbons, as shown by the increase in the percentage of them present in the finished gas; while the enormous reduction in the amount of

carbon monoxide present is due to the inter-action between it and the paraffin hydrocarbons in the presence of red-hot carbon—a point which makes the Van Steenbergh apparatus enormously superior to any of the superheated forms of plant.

After all, however, continued the lecturer, the reactions taking place, although they have an intense fascination for the chemist, are not the factors which the gas manager deems the most important; the cost of any given process being the test by by which it must stand or fall. It will, therefore, be well to consider now, as far as it is possible to do so, the expense of enriching coal gas by the various methods I have brought before you. In order to be well above the prescribed limit of illuminating power at all parts of an extended service, the gas at the works must be sent out at an illuminating power of 17·5 candles; and we may, I think, fairly take it that 16-candle coal gas, as made by the London Gas Companies, costs as nearly as can be, 1s. per 1000 cubic feet in the holder. The question we have now to solve is the expense of enriching it from 16 to 17·5 candle power. When this is done by cannel, the cost is 2·6d. per candle power; so that the extra 1½ candles would cost 4d. per 1000 cubic feet. Carburetting with the vapours of gasoline by the Maxim-Clark process costs 1¾d. per 1000 cubic feet; so that the extra candle power would mean an expenditure of 2·62d. Unfortunately, I have no figures upon which to calculate the cost of producing such a gas by the Dinsmore process; but with the three important water gas enrichers we can do so. Using Russian fuel oil, which can be obtained in bulk in London at 3d. per gallon, the proprietors of the Springer plant guarantee 5½-candle power per 1000 cubic feet of gas per gallon used; so that, to produce a 22-candle gas, 4 gallons of it would be used. The cost of 1000 cubic feet may therefore be roughly stated (the coke used being about 40 lbs) as follows: Oil, 1s.; coke, 3d.; labour and purification, 2d.; charge on plant, 1d.—total, 1s. 6d. Now, as 25 per cent. of 22-candle gas, when mixed with 75 per cent. of the 16-candle gas, gives the required 17·5-candle gas, it would therefore cost 1s. 1½d., or the enrichment would have cost 1½d. By the Lowe process, an increase of 5·3-candle power is guaranteed for the consumption of a gallon of the same oil; so that the cost would be a shade higher—all their factors remaining the same. With the Van Steenbergh process, both grade of oil and consumption of fuel vary from either of these processes. In order to obtain 1000 cubic feet of 22-candle gas, 2½ gallons of the lighter-grade oil would be consumed; and I am informed that there is now no difficulty in obtaining in London oil of the right grade, in bulk, at 4d. per gallon. This would make the cost as follows: 2½ gallons of oil, 10d.; 30 lbs. of coke, 2¼d.; labour and purification, 2d.; charge on plant, ¾d.—total, 1s. 3d. The enriched coal gas would therefore cost 1s. 0¾d. per 1000 cubic feet; the extra 1½-candle power having been gained at an expense of ¾d. or ½d. per candle. Tabulating these results, we have the following figures as the cost of enriching a 16-candle gas up to 17·5-candle power per 1000 cubic feet:—

By cannel coal	4d.
By the Maxim-Clark process . . .	2¼d.
By the Lowe or Springer water gas . .	1½d.
By the Van Steenbergh water gas . .	¾d.

In reviewing this important subject, and bringing a wide range of experimental work to bear upon it, I have, as far as is possible, divested my mind of bias towards any particular process; and I can honestly claim that the fact of the Van Steenbergh process showing such great superiority is due to the force of carefully-obtained experimental figures, corroborated by an experienced and widely-known Gas Chemist, and by the Chief Gas Examiner for the City of London.

In adopting any new method, the mind of the gas manager must, to a great extent, be influenced by the circumstances of the times; and the enormous importance of the labour question is a main factor at the present moment. With masters and men living in a strained condition, which may at any moment break into open warfare, the adoption of such water-gas processes would relieve the manager of a burden which is growing almost too heavy to be borne. Combining, as such processes do, the maximum rate of production with the minimum amount of labour, they practically solve the labour question. Requiring only one-tenth the number of retort-house hands that are at present employed, the carburetted water gas can be used for enrichment until troubles arise, and then the gas pure and simple can be used with a hardly perceptible increase in expense, while the rapidity of make will also give the gas manager an important ally in the time of fog, or in case of any other unexpected strain on his resources.

One of the first questions asked by the practical gas maker will be: "What guarantee can you give that, as soon as we have erected plant, and got used to the new process of manufacture, a sudden rise in the price of oil will not take place, and leave us in a worse plight than we were in before?" The only answer to this is that, as far as it is possible to judge anything, this event is not likely to take place in our time. A year ago the prospects of the oil trade looked black, as the output of American oil was in the hands of a powerful ring, who seemed likely also to obtain control of the Russian supplies. Fortunately, this was averted; and, at the present moment, the Russian pipe-lines are flooding the market with an abundant supply, which those best able to judge tell us is practically inexhaustible. Prices may therefore be expected to have a downward rather than an upward tendency. But even should a huge monopoly be created, I think I have found a source of light at home which will hold its own against any foreign illuminant in the market.

For a long time I have felt that in this country we had sources of light and power which only needed development, and the discovery of the right way to use them, to give an entirely new complexion to the question of carburetting; and now, by the aid of the engineering skill and technical knowledge of Mr. W. Staveley, of Baghill, near Pontefract, I think it is found. At three or four of the Scotch iron-works, the Furnace Gases Company are paying a yearly rental for the right of collecting the smoke and gases from the blast-furnaces. These are passed through several miles of wrought-iron tubing, gradually diminishing in size from 6 feet to about 18 inches; and as the gases cool, there is deposited a considerable yield of oil. At Messrs. Dixon's, in Glasgow, which is the smallest of these installations, they pump and collect about 60 million feet of furnace gas per day, and recover, on an average, 25,000 gallons of furnace oils per week; using the residual gases, consisting chiefly of carbon monoxide, as fuel for distilling and other purposes, while a considerable yield of sulphate of ammonia is also obtained. In the same way a small percentage of the coke-ovens are fitted with condensing gear, and produce a considerable yield of oil, for which, however, there is but a very limited market; the chief use being for the Lucigen light, and other lamps of the same description, and also for pickling timber for railway sleepers, &c. The result is that four years ago the oil could be obtained in any quantity at ½d. per gallon; though it has since been as high as 2½d. a gallon. It is now about 2d. per gallon, and shows a falling tendency. Make a market for this product, and the supply will be practically unlimited, as every blast-furnace and coke-oven in the kingdom will put up plant for the recovery of the oil. As, with the limited plant now at work, it would be perfectly easy to obtain 4 or 5 million gallons per annum, an extension of the recovery process would mean a supply sufficiently large to meet all demands.

Many gas managers have from time to time tried if they could not use some of their creosote oil for producing gas; but, on heating it in retorts, &c., they have found that the result has generally been a copious deposit of carbon, and a gas which has possessed little or no illuminating value. Now the furnace and coke-oven oils are in composition somewhat akin to the creosote oil; so that, at first sight, it does not seem a hopeful field for search after a good carburetter. But the furnace oils have several points in which they differ from the coal-tar products. In the first place, they contain a certain percentage of paraffin oil; and, in the next, do not contain much naphthalene, in which the coal-tar oil is especially rich, and which would be a distinct drawback to their use. The furnace oil, as condensed, contains about 30 to 50 per cent. of water; and, in any case, this has to be removed by distilling. Mr. Staveley has patented a process by which the distillation is continued after the water has gone off; and, by condensing in a fractionating column of special construction, he is able to remove all the paraffin oil, a considerable quantity of cresol, a small quantity of phenol, and about 10 per cent. of pyridine bases—leaving the remainder of the oil in a better condition, and more valuable for pickling timber, its chief use.

If the mixed oil so obtained, which we may call "phenoloid oil," is cracked by itself, no very striking result is obtained; the 40 per cent. of paraffin present cracking in the usual way, and yielding a certain amount of illuminants. But if the oil is cracked in the presence of carbon, and is made to pass over and through a body of carbon heated to a dull red heat, it is converted largely into benzene. As this is the most valuable of the illuminants in coal gas, and also the one to which it owes the largest proportion of its light-giving power, it is manifestly the right one to use in order to enrich it. On cracking the phenoloid oil, the paraffin yields ethane, propane, and marsh gas, &c., in the usual way; while the phenol interacts with the carbon to form benzene:—

$$\underset{\text{Phenol.}}{C_6H_5HO} + C = \underset{\text{Benzene.}}{C_6H_6} + CO$$

And in the same way the cresol first breaks down to toluene in the presence of the carbon; and this in turn is broken down by the heat to benzene. A great advantage this oil has is that the flashing-point is 110, and so is well above the limit; this doing away with the dangers and troubles inseparable from the storeage of light naphthas in bulk.

In using this oil as an enricher, it must be cracked in the presence of carbon; and it is of the greatest importance that the temperature should not be too high, as the benzene is easily broken down to simpler hydrocarbons of far lower illuminating value. This fact is very clearly brought out by a series of experiments I have made, in which the phenoloid oil was cracked by passing it through an iron tube packed with coke, and heated to various temperatures; the hydrocarbons being much more easily broken up under these conditions than if mixed with diluents such as water gas:—

Results obtained on Cracking Phenoloid Oil.

	I.	II.	III.
Temperature	600°	800°	1000
Volume of gas per gallon. .	41·6 c.ft. ..	76·8 c.ft. ..	121·6 c.ft.

Composition of the Gas.

	I.	II.	III.
Hydrogen	34·0	36·0	37·0
Methane	20·0	26·0	49·0
Olefines	11·0	5·0	nil.
Ethane	16·0	9·0	nil.
Carbon monoxide	13·0	15·0	12·0
Carbon dioxide	2·0	4·0	2·0
Oxygen	2·0	1·0	nil.
Nitrogen	2·0	4·0	nil.

These figures show that, if the temperature is allowed to reach a cherry red, complete decomposition of the illuminating hydrocarbons is taking place, and a gas of practically no illuminating value results. The power of regulating the temperature and the body of carbon as a cracking medium in the Van Steenbergh water-gas plant especially fits it for using this oil, and removes the objections which could have been urged against the lighter naphthas. The oil is not at present in the market; but, given a demand, it can be produced, in four months at the latest, in very large quantities, as the apparatus is easy and cheap to erect, and the crude material can be plentifully obtained. Those gas managers who distil their own tar could also, in the same way, use their own creosote oil, by adopting a process which has been devised by Mr. Staveley, and which entirely does away with the troubles that would otherwise arise from the amount of naphthalene present.

If this oil becomes, as I think it will, an important factor in the illumination of the future, it will mark as important an era in the history of our industries as any which the century has seen; for, by using it, you are giving smoke a commercial value, and this will do what the Society of Arts and the County Council have failed in—that is, give us an improved atmosphere. The smoke of London contains large quantities of these oils; and they, by coating the drops of mist on which they condense, give to the fog that haunts our streets that peculiar richness which is so irritating and injurious to the system, and further, by preventing the water from being again easily taken up by the air, prolongs the duration of the fog. If I were lecturing on an imaginary "Hygeia," I should say: Make this oil a marketable commodity; and another twenty years will see London without a chimney. Underground shafts will run alongside the sewers; and into these shafts, by means of a down-draught, all the products of combustion from our fires will be sucked by local pumping-stations. The oil, condensing in the tubes, will serve in turn to illuminate our streets, instead of performing its former function of turning day into night and ruining our health. But, unfortunately, I fear that such dreams would have a rude awakening when subjected to the test of practical possibility.

THE GAS UNDERTAKINGS RETURNS.

The returns relating to the gas undertakings of the United Kingdom—for the year ending Dec. 31, 1889, in the case of the Companies, and March 25, 1890, in the case of the Local Authorities—which were ordered by the House of Commons to be printed on the 9th of May last, were issued on the 15th inst., as briefly mentioned in the JOURNAL last week. It is gratifying to find that more promptitude has been displayed in their publication this year as compared with last; inasmuch as the order of the House was given five weeks later, and the papers were available something like two months earlier—the returns for 1888-9 not being issued till Feb. 20 of the present year. We gave last week the totals shown in the returns; and we now reproduce the principal figures.

The returns furnish particulars in regard to 405 authorized gas undertakings belonging to companies, as compared with 395 in the previous return. Nine of these are in Ireland. Local authorities to the number of 173 (the same as before) furnished information relating to their gas undertakings; and of these 139 are situated in England and Wales, 29 in Scotland, and 5 in Ireland. The total amount of capital authorized for these 578 gas undertakings is £76,593,724. The amount paid up and borrowed is £59,877,537. The total receipts are £15,846,089; the expenditure is £11,262,183. With regard to the working statistics, the quantity of coal and cannel carbonized in the periods covered by the returns was 9,663,011 tons; the gas produced therefrom being 98,081,283,319 cubic feet, of which 90,252,594,714 cubic feet were sold. There were 21,584¾ miles of mains in use for the supply of 2,244,105 consumers and 446,880 public lamps. The returns show, on the whole, an improvement in respect to the statistics furnished; though there are still a few instances in which the length of mains is not given, and certain local authorities are unable to state the quantity of gas made in their works. It may be of interest to mention, in support of the preceding statement as to the greater fulness of the returns, that in those for 1882 no information was furnished as to the mileage of mains; but from 1883 onwards the failures in this respect have gradually fallen from 46 to 6. In the case of the local authorities, the amount of the loans authorized for the gas undertakings includes, in a few instances, money raised for other purposes.

Comparing the foregoing figures with similar returns for previous years, it will be seen that the capital obligations of the Companies are as follows:—

Year.	Share and Premium Capital Paid up.	Loan Capital Issued.	Capital Sold under Auction Clauses.	Premiums realized.
1882.	£28,589,148	£4,345,787	£2,065,905	£957,561
1883.	29,038,726	5,075,804	2,538,709	1,088,675
1884.	29,594,464	5,330,550	2,810,415	1,188,750
1885.	30,109,429	5,404,141	3,088,460	1,306,238
1886.	30,960,026	5,679,830	3,209,564	1,393,773
1887.	31,556,788	5,839,792	3,354,093	1,473,656
1888.	31,736,024	6,002,510	3,488,588	1,517,902
1889.	32,117,202	6,090,546	3,641,730	1,563,595

Some of the other comparative details in the Companies' returns are—

Year.	Tons of Coal Carbonized.	Cubic Feet of Gas made.	Number of Consumers.	Public Lamps Lighted.
1882.	4,928,695	49,360,289,059	1,055,009	224,300
1883.	5,171,963	52,330,749,963	1,091,388	235,338
1884.	5,361,576	54,452,255,864	1,102,628	242,782
1885.	5,595,371	56,903,060,785	1,115,223	250,404
1886.	5,777,966	59,051,111,814	1,133,897	258,072
1887.	5,977,254	61,266,055,857	1,152,119	264,316
1888.	6,050,588	62,328,542,470	1,103,198	259,921
1889.	6,309,495	64,627,914,489	1,128,838	268,013

The somewhat similar figures for the Local Authorities are—

Year.	Amount Borrowed, including Annuities (not deducting Repayments).	Receipts.	Expenditure (exclusive of Amount in next Column).	Interest, &c., Paid.*	Net Profit after Payment of Items in preceding Column.
1882.	£17,326,183	£4,098,828	£2,759,304	£845,936	£510,268
1883.	17,874,351	4,252,296	2,877,732	873,921	524,010
1884-5	18,758,895	4,334,059	3,066,386	894,836	399,714
1885-6	19,619,416	4,348,105	3,117,989	901,773	355,469
1886-7	19,723,046	4,403,262	3,127,047	951,636	359,532
1887-8	20,081,435	4,495,093	3,161,604	923,157	439,467
1888-9	21,333,833	4,817,269	3,375,197	977,154	479,489
1889-90	21,669,789	5,067,843	3,627,578	971,755	486,483

* These figures include: (1) Interest paid on loans; (2) amounts paid for annuities; (3) amount of loans repaid; (4) amount paid for redemption of annuities; (5) amount placed to sinking fund.

Year.	Tons of Coal Carbonized.	Cubic Feet of Gas Made.	Number of Consumers.	Public Lamps Lighted.
1882.	2,352,062	23,223,054,342	916,962	137,011
1883.	2,459,341	24,507,217,850	928,458	140,198
1884-5	2,642,942	26,120,491,840	955,728	144,506
1885-6	2,783,533	27,734,666,850	979,802	151,670
1886-7	2,879,765	28,880,425,240	996,480	155,849
1887-8	2,985,577	30,105,457,962	1,011,139	159,264
1888-9	3,204,982	32,381,124,770	1,089,748	174,191
1889-90	3,353,516	33,453,368,830	1,115,267	178,867

Preservation of Iron Chimneys and Flues.—The Memorandum of the Superintendent of Works in Paris gives the following recipe for preserving wrought-iron chimnies and flues from oxidation: Brush over the inside of the pipe with a mixture of coal tar and pine tar. Then fill it with wood shavings and chips, and set fire to them. The tar is thereby calcined, and adheres to the metal, as well as covering its surface with carbon. A pipe so treated, it is stated, will last many years longer than one left unprotected.

The Price of Gas in Brussels.—In a paragraph in the JOURNAL for the 25th ult., it was stated that the Gas Committee of the Brussels Municipality had been considering the advisability, in view of an agitation which had been going on relative to the price of gas, of abolishing the existing differental rates—10c. and 15c. per cubic metre respectively for day and night gas—and adopting the uniform figure of 12c. Although the change would have adversely affected the consumers of day gas, it was thought that there would be an all-round benefit. The deficiency in the budget resulting from the reduction, it was proposed to make up by the imposition of an additional 3 per cent. on the general rate. We learn, however, from a Brussels correspondent, that the proposal has been rejected by the Municipality, after a debate extending over two sittings. Two amendments were brought forward—one for a reduction to 12c., the other to 14c. The former had only four supporters; but the latter was adopted by 16 votes to 10. Henceforth, therefore, the consumers of night gas (or rather gas to be used for illumination, as distinct from heating or motive power) will be benefited to the extent of about 2½d. per 1000 cubic feet, the concession of which will not impose any additional burden upon the citizens generally. It may be presumed that this arrangement will be satisfactory to all parties concerned, inasmuch as the Municipality will have yielded to the agitators for a reduction, the members of the Council who promised to support them will have fulfilled their "platform" engagements, and the authorities will not incur any odium in respect of additional taxation.

AMERICAN GASLIGHT ASSOCIATION.

[Abridged from the "Official Report" in the *American Gaslight Journal.*]

(*Continued from p.* 1243.)

The next item on the programme was a paper by Mr. E. G. Pratt, of Des Moines, Iowa, on "The Extension of the Uses of Gas for Purposes other than Illumination." The writer considered that the increased use of gas which had been the general experience of late years was to be ascribed rather to the larger demand for stoves and heaters consequent upon reductions in the price of the fuel to be employed therewith, than to any special efforts put forth in the way of introducing it by the companies; and that the time had now come when it was desirable not only to meet the existing, but to seek the creation of fresh demands for gas. He had recently been making special efforts at his works in the way of pushing the sale of gas, and was fairly satisfied with the results. Very great care had been taken to recommend only the best class of appliances. He was opposed to the hire system, and advocated the hire-purchase arrangement. Stoves kept in stock for hiring soon became old fashioned; and he was in favour of sending out the newest and best kinds only. A shop was rented in a prominent position, and furnished with an attractively-arranged and carefully-selected stock of stoves, &c. They were fitted with supply-pipes, so as to be put into use at a moment's notice; and a salesman competent to give practical demonstrations of cooking, &c., to any customer was engaged. Advertising was very freely resorted to; and a reduction of 25 per cent. offered on gas used for fuel. The ordinary price being 8s. 4d. per 1000 cubic feet, this brought the special rate to 6s. 3d. The appliances were sold at 10 per cent. profit, and were fixed gratis. The special rate for gas and the cheap sale of stoves, which were fitted up without further charge, had been especially successful in bringing in business. Liberal allowances were made for discarded oil-stoves. A lady lecturer was engaged to give cookery demonstrations. One result was that cooking-stoves had been retained for continual, and not for summer use only; and heating-stoves had been largely introduced. As to gas-engines, he thought that if it paid the makers of electric motors to canvas every town and city in the country, it would certainly pay the makers of gas-engines to do so in places where gas was sold at 5s. 3d. or less per 1000 cubic feet. And if gas engineers wished to push the use of gas-engines, they must take care to use them at the gas-works. He made a practice of fixing a separate meter to measure the gas used at the special rate; all attempts to get at it by estimation, &c., having proved unsatisfactory. His consumption of gas had increased 22 per cent. during the first eight months of the year, as compared with the corresponding period for 1890; and he had sold 121 stoves.

In the discussion following the paper, Mr. Butterworth said that at Columbus the difficulty was not to get fresh business, but to retain that which they had, in the face of natural gas sold at 5d. per 1000 cubic feet. Mr. A. C. Humphreys suggested that natural gas would be exhausted in time; and, in the meanwhile, people would become accustomed to the use of gas. If, therefore, the previous speaker could "hang on," his harvest-time would eventually come. With regard to both gas stoves and engines, there was room for better articles at lower prices, and if the makers of these appliances would not meet gas suppliers' wishes, they would have to do it for themselves. Gas-engines, especially, had not been handled with the slightest liberality. Mr. Taber said that gas managers had done a great deal in the way of putting out cooking and other stoves, though he agreed that there was yet plenty of room for further effort. In gas heating-stoves, particularly, there was a field for future development. In order to save the expense of an extra meter, he allowed a reduction on all gas used over a certain agreed quantity. Mr. Boardman had found that, with gas at 1s. 10½d. per 1000 cubic feet, and coal at 11s. 6d. per ton, the cost of gas for running a 100-horse power gas-engine for 12 hours would be about 56s., and that of coal for raising steam to produce a similar amount of power would be 47s. The gas-engine would cost a little more than the boiler and steam-engine. Mr. Dixon said this might be the case for large engines; but, with engines below 25-horse power, gas was a long way ahead in point of cheapness, and it was also 25 per cent. cheaper than electric motors. Mr. Coggshall complained that while makers of electric motors and oil-stoves advertised largely at their own cost, if gas appliances were advertised, the gas company had to bear the whole expense. Mr. Scriver said he sold gas at a special low rate for fuel purposes; and also made his own stoves, and sold them at a very small profit. He knew of an instance where a gas-engine, costing 3s. 4d. per day for gas, had replaced a steam-engine that cost about 5s. There was a demand for a good gas-heater for circulating boilers. The President (Mr. Emerson M'Millin) said there were two sides to the question of cheap stoves. He had been able to arrange with a manufacturer to fit up stoves gratis, if sold at a fixed rate of profit. The result was that the maker had taken up the thing very energetically, and sold a large number of stoves.

An interesting and suggestive paper, especially for young gas engineers, was read by Mr. F. H. Shelton, of Philadelphia. It was entitled "The Gas Engineer and his Pencil;" and it comprised various hints on the subject of mechanical drawing, together with some notice of the various ways in which this would be useful to managers of gas-works. Full particulars of the preparation of a ground plan of the works were given; and it was suggested that the following details should be marked plainly on it: Inside dimensions of all rooms; clear widths of gates and roads; names of streets, railways, rivers, and owners of adjoining properties; level of railway; capacity of coal-sheds, gasholders, liquor-tanks, with diameters and depths of tanks; pressure given by holders; and particulars of each piece of apparatus, such as the maker's name and the year in which it was erected. Separate drawings of all details should be kept, and care taken at the time to see that they were corrected in accordance with the many little changes that were almost sure to have been made in the course of erection. As regards distribution, the importance of complete drawings, showing every service, syphon, valve, and public lamp, was enlarged upon; and several suggestions were offered, such as the indication of various sizes of main pipes by different colours—commencing with dark tints for the larger pipes, and gradually proceeding to lighter ones as the size of pipe diminishes. Each colour might be made to do duty for three sizes of pipe, by using the plain line, a heavy dot and dash, and small light dashes. In addition to the general plan of the district, several large-scale drawings, each showing a particular part of the district, were necessary; and these should show all things likely to be useful, including sketches of the principal obstacles encountered, pipes or conduits crossing or interfering with the line of main, and not only each valve, but also the place where the key is kept. These sheets might be bound in book form; and a rough copy on a small scale, pocket-book size, would constantly be found very useful to the main and service layers, and other employees. The representation of statistics of output, leakage, or other data, was mentioned as affording a useful means of reference and comparison; and several outlines for drawings or charts of this kind were given. In conclusion, the author remarked that if time or want of ability interfered with the preparation of highly-finished drawings, rough pencil sketches, having the dimensions marked in, were better than nothing; while for some purposes they were preferable to more elaborate ones.

The paper led to a conversational discussion, in the course of which several gentlemen related their practice or experience in connection with the preparation of plans, &c. Mr. M. S. Greenough, of Boston, said he had charts showing the cost of labour, coal, and other matters, in each year; and he suggested whether the numerous details indicated for the plans of mains and pipes would not be rather too much. At any rate, he found a plan showing the main-pipes only, and these all of one colour, to be useful for several purposes. Mr. Adams spoke in favour of keeping comparative records of yields from various materials, of residuals, &c.; and thought that if these could be collected for the use of the members of the Association, they would be extremely useful. Mr. Harbison said that some years ago he experienced considerable difficulty on account of the absence of a plan of mains; and he now took care to be well provided in this way. He therefore strongly favoured the suggestions in the paper. Several other speakers followed in support of keeping the fullest possible records, in the form of sketches or drawings, of the various works carried out.

(*To be continued.*)

Society of Civil and Mechanical Engineers.—Last Wednesday the opening meeting of the current session of this Society took place at the Westminster Palace Hotel, when Mr. R. Nelson Boyd, M. Inst. C.E., the President-Elect, took the chair, in succession to Mr. Henry Adams, M. Inst. C.E. Mr. Boyd then read his opening address; the subject being "Petroleum—Past, Present, and Future." The author pointed out that the supplies of petroleum in different parts of the globe are immense—more than could ever be applied to illuminating purposes; and that it is destined to become the fuel of the future. At the present time it is not likely to be used on board steamships as fuel—on account of the absence of depôt tanks at convenient points where steamers might require further fuel. The railways in this country are also not likely to adopt fuel which has to come from such a distance; but the author suggested that liquid fuel might be used with advantage on the underground railways, as it burns without smoke or smell.

The Artesian Well Boring in the City of London.—At the meeting of the Commissioners of Sewers of the City of London last Tuesday, reference was made to the artesian well which is being sunk under their supervision in Aldgate, and which has in the course of its career been subject to certain vicissitudes. Mr. Ross reported that since the last meeting of the Court the contractors had sunk the cylinder another 3 ft. 6 in.; the total depth now being 197 ft. 6 in. The approximate depth would have to be about 230 feet. Mr. Malthouse asked what soil the contractors were passing through. Mr. Ross replied that it was sand. Mr. Malthouse said it was very slow work; and he could not understand it. Mr. Ross explained that the progress was considered good, because the contractors were working through 100 feet of water. Mr. Woodrow said he had been down the well as far as the surface of the water; and although at that point progress had been difficult, he thought since then better progress might have been made. Mr. Malthouse inquired when the contract would expire. Mr. Ross replied that it had expired about a fortnight ago; but the fact was not reported, as it had escaped his notice.

REGISTER OF PATENTS.

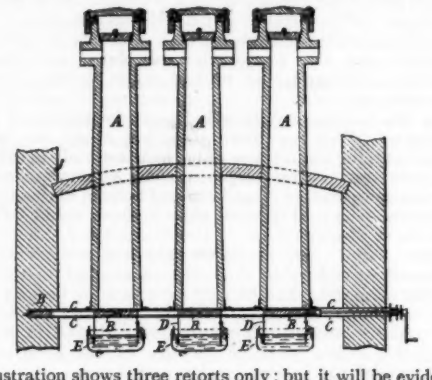
Gas-Meter Dials.—Danks, A. T., of Melbourne, Victoria. No. 20,194; Dec. 16, 1889. [8d.]

This invention relates to the construction of gas and other meters with additional revolving dials of larger diameters than the ordinary dials; such additional dials carrying numbers arranged upon their faces in such positions that they can be read in a single line through openings in the front plate of the meter.

The speciality consists in attaching a circular disc to the spindle of each index-finger, which disc must be sufficiently large to allow of an annular space or ring being formed around its edge, on which to mark figures corresponding with those on the dial in front; and there must be an opening cut in the dial-plate, immediately under each of the dials, so as to expose one only of the numbers marked on the annular space of the disc at the back—the numbers, of course, being so arranged that, when the index-finger points to a number on the dial, the opening below will show a corresponding figure.

Manufacture of Gas.—Cotton, W. T., of Camberwell New Road, London; and Crowther, E. F. B., of Withington, Lancs. No. 343; Jan. 8, 1890. [6d.]

This invention relates to the manufacture of gas from coal carbonized in a series of vertical or inclined retorts. These retorts may be of fire-clay or metal; and they taper internally—their larger diameter being at the bottom, where they are supported upon the upper plate of a box or casing. The casing encloses a draw-plate, provided with apertures, which may, when desired, be brought to correspond with apertures situated immediately below the retorts and formed in its upper and lower plates. By causing the apertures in the draw-plate to come beneath the lower extremities of the retorts, the carbonized products drop through exit-tubes projecting from the underside of the casing, and fall out below. After the retorts have thus been emptied, the draw plate is again caused to assume its normal position, so as to close the retorts. A receptacle or pan, hinged to each of the exit-tubes, and containing water into which tubes dip, forms a seal to prevent air entering to, or gas escaping from, the retorts through the draw-plate, box, or casing.



The illustration shows three retorts only; but it will be evident that any number may be employed—their upper ends being connected together by unions.

A are the retorts, arranged vertically (but they may, if preferred, be arranged in inclined positions); and B is the draw-plate carrying slabs of fire-resisting material bolted thereto. C is the box or casing enclosing the draw-plate, and provided with apertures; and D are the exit-tubes, which project into the receptacles or pans E, and dip below the level of the water contained in such receptacles—thereby forming a hydraulic seal. The upper ends of the retorts are furnished with pivoted covers and lids. By turning these covers about their pivots and removing the lids, coal can be charged into the retorts, and it drops into the lower part thereof, where it is supported by the solid portions of the slabs carried by the draw-plate. The products of combustion from the furnace, by entering the space beneath the arch shown, heat the portions of the retorts contained therein; and thus carbonize the coal and liberate the gas, which passes off to the hydraulic main in the usual manner.

When the retorts are to be emptied, the spring catches at the bottom are released; and the pans E immediately turn downwards upon their hinges. The crank-handle operating the screw shown, is now turned; and the apertures in the draw-plate are thus brought beneath the retorts, and correspond with the openings in the box or casing. The carbonized products then fall, by their own weight, through the exit-tubes D into a barrow or waggon beneath, and the draw-plate is again caused to assume the position shown. The pans are then raised into their horizontal positions, and retained thereby the spring catches. Water is then admitted to the pans, to make the water seal or joint; and the pans are kept supplied with a sufficient quantity of water until they are again unlatched before emptying the retorts.

Swing Gas-Bracket with Mercurial Seal.—Stott, J., of Oldham. No. 487; Jan. 10, 1890. [6d.]

The object of this invention is to provide a gas-bracket for use in foundries, and erecting shops, factories, wharves, warehouses, and other places, to project a sufficient distance from the wall to bring the light over the centre of the floor space and which by a simple movement can be swung aside so as to allow of the passage of travelling cranes, jib cranes, or the erection of machinery. The ordinary form of gas-bracket, with tapered-plug swivel-joint is, of course, only suitable for short brackets; excessive leverage caused by an undue length of arm speedily wearing or grinding away the joint and resulting in an escape of gas.

The invention consists of an iron bracket, formed with an annular trough, charged with mercury. Working in this trough is a dip-pipe, kept in position by a pivot working in the angle bracket. The supply of gas is admitted at the bottom, whence it passes upwards through the dip-pipe and along the arm; any escape of gas being prevented by the mercury seal. The overhanging weight of the arm is carried by a strut or hanger working on a gudgeon fixed to the wall at a suitable distance above the mercury joint; and the projecting arm may be protected from accidental movement by a semi-circular weight or curtain fixed to the wall by pivots in such a manner that, by its weight, the arm is retained at any desired position.

Gas-Engine.—Cruikshank, G. M.; a communication from C. White and A. R. Middleton, of Baltimore, U.S.A. No. 16,301; Oct. 14, 1890. [8d.]

This gas-engine comprises a jacketed cylinder of a size and length and diameter varying according to the work for which it is intended; a cooling medium, such as air or water, being introduced within the space between the walls. The piston is propelled by the explosion of a mixture of gas and air admitted to a chamber in the rear of the piston; the arrangement being such as to allow of an explosion after every other reciprocation of the piston, or of less frequency if the work does not require alternate explosions—the frequency of the explosions being automatically controlled. The explosion chamber also serves as a compression chamber for the mixture preparatory to its ignition. The piston is of tubular form with its rear end closed except where a port is made leading from the explosion chamber to a channel passing through the piston for about half its length, and opening through an elongated port to the exhaust-pipe. The port in the end of the piston is provided with a valve, which closes the passage to the exhaust under certain conditions, and is operated to open it under other conditions. The valve is supported upon a stem guided in its movements by the walls of the openings through which it passes; and the front end of the stem carries a spring, the tension of which may be regulated as required. After an explosion has taken place, the piston is driven to the front until its rear edge reaches the exhaust port, when the exploded mixture flashes out, and the force of the charge is spent. In this forward movement, the valve is tightly closed upon its seat, which is made dish-shaped so as to bring the outer face of the valve flush with the rear face of the piston. But as the backward movement of the piston takes place, the valve is moved forcibly from its seat, and an exit is opened through the channel to the exhaust for the escape of the foul mixture. This frees the space in the rear of the piston from the exploded compound; and thus the next charge admitted is practically entirely fresh, and a minimum amount of the old mixture remains. The gas or vapour is admitted to the explosion chamber through ports covered by a valve, normally closed by a spring, but opened to admit a charge by the suction of the piston as it moves forward after the chamber has been emptied of the exploded mixture. The gas or vapour is admitted to the space in the rear of the explosion chamber through a pipe in connection with any suitable source of supply; but the flow of gas is interrupted by a valve automatically controlled by governor mechanism, which, by allowing or preventing the flow of gas to the chamber, controls the number of explosions, and which opens to admit the gas, according to the requirements of the work.

APPLICATIONS FOR LETTERS PATENT.

19,999.—Lea, R. H., and Cooper, E. W., "Improvements in gas and vapour engines." Dec. 8.

20,002.—Dauber, A., "A gas generator." Dec. 8.

20,020.—Welch, W., "Improvements in appliances to utensils heated by gas and other burners." Dec. 9.

20,030.—Vestraut, L. van, "Improvements in apparatus for charging inclined gas-retorts." Dec. 9.

20,031.—Perry, J., "Improvements in gas, oil, and other heat engines." Dec. 9.

20,068.—Campbell, J., "Improvements in illuminating vehicles, &c., by compressed gas." Dec. 9.

20,069.—Moore, L. G., "An improved gas-governor and pressure-indicator." Dec. 9.

20,101.—Ruler, W., and Moeller, J., "An improvement in incandescent gas-burners." Dec. 9.

20,103.—Crossley, F. W., "An improvement in gas and oil motor engines." Dec. 9.

20,105.—Normanville, S. A. de, "Improvements in gas and other similar motor engines." Dec. 9.

20,224.—Kershaw, P. B. W., "Improvements in gas-engines." Dec. 10.

20,226.—Albrecht, V., "Improvements in and connected with motors worked by gases under pressure." Dec. 10.

20,265.—Cormell, J., "Improvements in gas-regulators." Dec. 12.

20,286.—Vassort, E., "Improvements in photometers." Dec. 12.

20,295.—Wilson, A. E., "Improvements in regenerative gas-lamps." Dec. 12.

20,316.—March, L. R., "Improvements in liquid-meters and hydraulic motors." Dec. 12.

20,333.—Miller, H. P., "A new or improved gas union." Dec. 13.

20,356.—Gurd, W. J., "Improvements in meters for measuring and registering fluids, gases, and the like." Dec. 13.

Northern Coal Trade.—There was an expansion of the coal trade last week, in consequence partly of the demand usual before the holidays, and partly because of the expectation that a rather serious railway strike would take place in the Tyneside district in the current week. The miners have produced large supplies as usual before the holidays; and there has been a considerable shipment. Best Northumbrian steam coal has sold at about 11s. 6d. per ton free on board; second qualities, at 10s. 6d.; and small steam, from 5s. to 6s. For gas coal, there has been a heavy demand; and about 10s. 6d. per ton must be looked upon as the current price. It may be desirable to state that the contemplated strike will interfere very little with the shipment of gas coals, so many of the collieries having private lines to the river or port.

CORRESPONDENCE.

[We are not responsible for the opinions expressed by correspondents.]

The Supply of Steam to Regenerator Furnaces.

SIR,—I think Mr. Tysoe is to be congratulated on the device of a simple and ingenious arrangement of fire-bars for distributing water below the regenerator furnace; but though this is probably as efficient a method as it is possible to devise for the purpose, I still maintain that the use of water direct in any form is a crude, imperfect, and unscientific mode of obtaining steam for furnace use.

When steam is supplied direct, it is admitted in regular fixed quantities during the 24 hours; and it is distributed evenly over the under-surface of the fire—thus being brought into contact with all parts of the fuel as perfectly as the air itself. But when it is generated on the fire-bars, its even distribution is impossible; and the quantity generated is fitful and irregular at different periods of the 24 hours. As the lower portion of the fuel is consumed, combustion recedes; and the farther the fire is separated from the bars by the ash, the generation of steam becomes less, until at the latter portion of the 24 hours it is almost *nil*, though at this time it is required as much as at any other.

If there is no oxidation and destruction taking place with the fire-bars Mr. Tysoe uses, it is a most remarkable phenomenon in the application of wrought iron for this purpose, and contrary to all previous experience in the behaviour of wrought iron subjected to alternate heat and moisture.

Mr. Tysoe's fuel returns are, if possible, even more remarkable still. But if, as I suspect, they are based on the difference of an assumed make of coke per ton and a definite sale, I am surprised at Mr. Tysoe's modesty at stopping short at 7·5 tons per 100 lbs. of coal carbonized, when it is just as easy to show a fuel account of 1 or 2 per cent., according to the preference for odd or even figures. If a figure is to be assumed, it may as well be low as high—*e.g.*, if we assume the make of coke per ton to be the old chaldron of 12 cwt., though Newcastle and Durham coal produces nearly 15 cwt., and there is a sale of well-watered coke of 11 cwt. per ton, the fuel account will then be 1 cwt. of coke per ton of coal carbonized, or 5 lbs. per 100 lbs. of coal. This is a much simpler figure than 7·5 or 9·75 lbs.; and decimals for such a purpose are surely superfluous.

It may be that Mr. Tysoe's figures are based on two assumptions—viz., on the sales as well as on the make—since I have heard that the coke is not weighed at all at East Greenwich.

I hope we are not going to have the old dish hashed up again, as to the utility of regenerator flues for heating our secondary air supply, which was threshed out *ad nauseam* in 1884, and its ghost laid in the publication of Professor Harold B. Dixon's experiments. Most intelligent people would admit that all the heat you can restore to your setting by abstracting that from the waste gases, is so much net gain, and a corresponding proportion of fuel is thus saved.

That there is a considerable saving in fuel with the simple generator, as compared with the ordinary furnace, I am convinced should take place. But the saving will be much increased—almost doubled—by a good system of regeneration, I know; and this is one of the matters I have tried to elucidate in my paper. The extra cost for the regenerator flues is not great, and the expenditure on them is justified in quite as great a degree as it is on the producer.

I have heard of generator settings (and on South Metropolitan lines, too) in which there is no saving of fuel; but the settings have effected a considerable saving in labour, which quite justifies their erection.

The figures both as to fuel consumption and others quoted in my paper are all based upon actual weighings and measurings. The coal was all weighed in, and the coke out. The coke used for the furnace was weighed hot, as drawn from the retorts, including all its breeze, bass, and dust. The figures are the means of a number of experiments, each lasting five days; and in making them, the utmost care was taken to obtain absolute facts.

The coke used for fuel was from the Nottinghamshire hard cannels, containing a rather large percentage of ash. With better materials, the fuel account would no doubt be less. More complete combustion could not, however, take place; and I do not think it possible to do more in regeneration, since the gases enter the chimney at a temperature of only 600° Fahr.

WILLIAM R. CHESTER.

Nottingham, Dec. 19, 1890.

The Bowman Oxygen Company.

SIR,—I observe that a prospectus has been issued by the above Company, copy of which has been sent to many gas engineers, announcing its formation with a capital of £125,000. This undoubtedly is to be commended, provided the process is satisfactory as regards efficiency and cost; because the more cheaply oxygen can be produced, the better for gas companies, as it is now generally acknowledged that without its aid gas purification can only be carried on in an incomplete and therefore imperfect manner, with the risk of creating great nuisance to the neighbourhood in which the works are situated. I have seen lime that has been treated with pure oxygen come out of the purifiers, after being totally used up, containing 20 per cent. of sulphur, and so odourless that it might easily be left in a room without its presence being detected.

The question I should like to ask with regard to the Bowman process is whether it is identical with, or a modification of the well-known Tessié du Motay process, which was tried in New York and in Paris some 20 years ago, and failed. As many to whom I have spoken are of this opinion, perhaps someone in connection with the Bowman Company will enlighten us.

C. V. BENNETT.

Wells, Somerset, Dec. 19, 1890.

SIR,—I observe in a recent issue of the JOURNAL that reference is made to the formation of a Company having for its objects, among other things, the application of oxygen to the following specific purposes: (1) Lighting by combining oxygen with coal gas, oil gas, and water gas; (2) purification of gas; (3) bleaching cotton, flax, jute, and other materials from which fibre is obtained for manufacturing purposes.

It may be of interest to your readers to know that Brin's Oxygen Company and the Continental Oxygen Company are the proprietors of patents for the objects Nos. 2 and 3; and that they have the control of other patents covering object No. 1, for Great Britain and its colonies, France, Belgium, Italy, and other foreign countries, including Germany and the United States. They desire it to be understood that proceedings will be taken against any person infringing their patents.

T. N. HESTER, Secretary,
Brin's Oxygen Company, Limited, and
The Continental Oxygen Company, Limited.

Connaught Mansions, Victoria Street, S.W., Dec. 19, 1890.

The Heating and Ventilating of Victoria Infirmary, Glasgow.

SIR,—Permit me to refer to the paragraph in last week's issue of the JOURNAL regarding the heating and ventilating of the Victoria Infirmary. It has occurred to me that your readers might be interested in knowing what is the cost for gas to drive the "Otto" gas-engines for this purpose.

The expense for gas is equivalent to a cost of 1·42d. for every million cubic feet of air propelled into the building; and 2 millions of washed and warmed air are sent into the Infirmary every hour. The expense referred to as being "high relatively to the number of patients treated," is that of the heating, ventilating, and electric lighting, &c., of the administrative block of buildings, which are completed and equipped suitably for the Institution when there might be 400 patients in other three or four pavilions; whereas only one pavilion, containing wards for 80 patients is at present built, although the Governors are about to make considerable additions to the accommodation for patients, when the same system of ventilating and heating will be applied.

WILLIAM KEY.

Glasgow, Dec. 20, 1890.

Water-Works for Spain.—The municipal authorities of Toledo are offering a prize of £160 to the person who shall present the best scheme for the supply of water under pressure to the town, and a prize of £80 for the second best scheme.

The Patent Gasholder Syndicate have, we understand, entered into negotiations for granting royalties for the erection of a two-lift 120-feet diameter "columnless" gasholder in Germany, and for a single-lift 60-feet diameter one for Austria. These will, we believe, be the first holders constructed on the Continent under the patents of Messrs. Gadd and Mason.

The Cardiff Corporation and Unionism.—At a meeting of the Lighting Committee of the Cardiff Corporation last Tuesday, a discussion took place on the question of employing firms who do not pay the scale of wages laid down by the trades organizations of the district. The tender of a firm for the supply of lamp-posts was rejected, although the lowest, on the ground that the firm did not pay union wages; the tender accepted being £40 higher.

The Paris Electric Lighting Companies.—The four principal electric light companies in Paris, who hold concessions for 18 years from the Municipality, are, says the *Electrical Review*, following the example of the Paris Gas Company, by seeking to obtain an extension of their powers to the year 1930. For this purpose they have submitted to the Municipality a memorial offering to reduce the price charged for the light, provided their concessions are prolonged to that year.

The Staines and Egham Gas Order.—The notice of the intended application of the Staines and Egham District Gas Company, Limited, for a Provisional Order to enable them to extend their limits of supply, came before the Middlesex County Council on Thursday last. The consent of the Council was given, on the understanding that clauses protecting the interests of the county should be inserted in the Order. One matter for which the Company will be asked to make provision is the establishment of a testing-station away from their works.

Leeds Corporation Gas Affairs.—The Gas Committee of the Leeds County Council had before them at their meeting last Thursday several interesting matters. In the first place they decided, in order to increase the consumption of gas, to purchase a large number of gas-fires, to be let out to the public as required at a half-yearly rent or on purchase. A similar system is already in operation in Leeds with regard to the letting and sale of gas-ovens. The Committee also decided to introduce a new mode of applying gas to existing ovens; thus obviating the necessity of replacing them by the ordinary style of gas-oven. It was further determined to lay down a new 10-inch main to the outlying township of Rodley, at an estimated cost of between £3000 and £4000. The present main has become inadequate for the supply of gas to the township. Finally, the meeting appointed a Sub-Committee to confer with the Finance Sub-Committee on the question of the collection of the accounts for gas residuals—a subject to which reference has been recently made in these columns.

The Nottingham Corporation and their Gas Employees.—Last Thursday a deputation consisting of four workmen (one each from the Radford and Basford gas-works and two from the gas-works at Eastcroft) accompanied by Mr. T. Corbett, representing the Nottingham Trades Council, waited upon a Sub-Committee of the Gas Committee of the Corporation. The meeting was of a private character; but it is understood that the question raised affected mainly a re-arrangement of working hours—the subject of the remuneration of the workmen employed at the gas-works being upon this occasion of secondary importance. It seems that the only dispute was really one concerning the Eastcroft workmen; those at Radford and Basford being satisfied all round. A desire was expressed that the Committee should acknowledge the Gas Workers' Union; but the deputation were informed that the Committee had nothing whatever to do with the question of a Union—that a man was never asked whether or not he was a member of any Union. The Committee were decided, however, that no bills or placards in connection with any movement of the kind should be posted at any of the Corporation works. The interview is believed to have been of an entirely satisfactory nature.

LEGAL INTELLIGENCE.

HOUSE OF LORDS.—Monday, Dec. 15.

(*Before the* LORD CHANCELLOR, *Lords* WATSON, BRAMWELL, *and* MORRIS.)

Holliday and Others v. Corporation of Wakefield.

This was an appeal from a decision of the Court of Appeal reversing a judgment of the Divisional Court in a special case stated by the Arbitrator in certain proceedings. The question raised was whether the appellants were entitled to the sum of £4777, contingently awarded in respect of parts of a seam of cannel coal supposed to be underneath or near water-works constructed by the respondents at Ardsley, in the county of York, which seam the appellants alleged they were prevented from working by reason of the construction of the works. The appellants hold a lease, which will expire in 1913, to work four seams of coal underlying the surface of the land at Ardsley. In 1880 the respondents obtained an Act of Parliament authorizing them to construct their works, part of them passing over the surface of the land under which the coal seams in question lay. In June, 1883, the appellants gave notice to the respondents, pursuant to the Water-Works Clauses Act, 1847, that they intended to work the seams of coal in question. In July of the same year, the respondents gave a counter-notice, to the effect that the appellants' notice was premature and unauthorized, because the appellants' mines were not then sufficiently opened or advanced to entitle them to give the notice. Further notices having been given on each side, the whole matter was referred to arbitration. The Arbitrator found that the appellants had not begun to work the cannel seam; that but for the interference of the Corporation the appellants could, and would, before 1913, have worked the whole seam under the reservoir and within 40 yards of its boundary; that the workings of the appellants had not approached the reservoir in such a manner as to cause any present risk to the appellants' mines; but that, assuming the respondents to purchase and retain *in situ* 36 acres of the Middleton seam, and no other coal in that or in any other seam, the cannel seam could not be prudently worked to the extent of more than 50 per cent. of its contents under the reservoir without risk of injury to the mines. He therefore awarded the appellants the sum of £4777 as compensation in respect of the restriction of their future works by reason of such apprehension, if the respondents should be held liable to pay compensation on this ground. The Queen's Bench Division held that the respondents were liable to pay the compensation now; but this decision was reversed by the Court of Appeal. The case, which has been several times referred to in the JOURNAL, was argued before their Lordships last March, and judgment reserved.

Sir H. JAMES, Q.C., Mr. MEADOWS WHITE, Q.C., and Mr. R. S. WRIGHT appeared on behalf of the respondents; the ATTORNEY-GENERAL (Sir R. E. Webster, Q.C., M.P.), Mr. RIGBY, Q.C., and Mr. G. BANKS for the appellants.

Their Lordships gave judgment to-day, dismissing the appeal.

The LORD CHANCELLOR: I think the question in this case turns upon the true construction of the Water-Works Clauses Act, 1847; and, before dealing with the particular clauses under which the question arises, it is material to notice what is the problem the Legislature had to solve in giving compulsory powers for the construction of water-works, and the contingencies that were likely to arise in the maintenance of the works so constructed. With reference to some public works of a different character, such as railways, and the like, two principles appear to have been established as those upon which legislation should have been founded—one, that the works when so established should not be subject to be impeached in a Court of Law for any damage or annoyance they might cause by reason of their ordinary use; and, as a correlative of this principle, that any person whose land would be injuriously affected by the construction of the works should, in lieu of his right of action, be entitled to compensation—compensation which must, except where otherwise specially provided, be assessed once and for ever, and not be subject to increase or diminution after that one assessment. The Legislature having before its mind the peculiarity of water-works, departed, in the statute under construction, from both these principles. Compensation, in the form of damages, might still be claimed against a water-works company, notwithstanding that the works were constructed and maintained by virtue of an Act of Parliament, and compensation, as such, might be made from time to time, and not be assessed once and for all. It is not difficult to see what was in the mind of the Legislature when dealing with such a subject-matter as the establishment of large reservoirs of water in relation to underground workings by persons, other than the undertakers of the water-works, in winning minerals which *primâ facie* were not to belong to the undertakers of those works. The undertaker and the mine-owner have a common interest in the security of the reservoir—the one to preserve the water which the reservoir was intended to retain; the other to keep the power of working out the minerals which the leaking of the reservoir would prevent them from winning by the drowning of the mine. But, except so far as it should be necessary to preserve both these rights for those respectively interested in them, the Legislature appears to have thought that it was expedient that both mine-owner and water-works undertaker should each be left free to pursue his industry without interference. It is the interest of the mine-owner to be allowed to retain his mine; it is the interest of the water-works undertaker not to be called upon to pay more for land than was necessary for the purpose of his undertaking. Accordingly, while the 6th section of the Water-Works Clauses Act, which in terms refers to the construction of the works, enables the undertakers, if they please to pay for it, to take all land, including mines, for the construction of their works (and I cannot doubt that in this section the word "land" does include mines and minerals), yet by the 18th section of the Act, and the sections which follow it, the relations between the owners of the water-works and the mines are, I think, intended to be exhaustively regulated; and I agree with the Master of the Rolls, if not altogether for the same reasons, that compensation, if it can be given at all, must be sought for in the statute under the rules especially relating to mines. Now, it is provided that the mine-owner shall not get his minerals within the prescribed distance of the water-works without giving due notice to the undertakers—obviously to afford the undertakers the opportunity to purchase if they will, and so prevent any working beyond the prescribed distance. The Act itself prescribes a distance, if no distance is prescribed by the Special Act; but it contemplates the possibility of the undertakers [being familiar with the works they are about to execute, and procuring a different prescribed distance from that which the Act itself enacts in the absence of any special prescribed distance. Now, this being, so far, the scheme of legislation, let us see what are the facts on which the question in debate arises. This depends on the 13th paragraph of the finding of the Arbitrator, which is as follows:—

"The workings of the claimants have not as yet approached the reservoir in such a manner as to cause any present risk to the claimants' mines or seams from the existence of the reservoir, assuming it to be filled with water. If the claimants were free to work their mines and seams without risk of interruption from the works of the Corporation, they could, and would, have got the whole of the Middleton and cannel coal under the reservoir, and within 40 yards of its boundary, within the respective terms of the leases. Assuming the Corporation to purchase and retain *in situ* the 35a. 3r. and 34p. of the Middleton seam for which they have given notice, and no other coal in that or any other seam, the claimants, by reason of the Corporation works, and of apprehension of injury therefrom to the cannel seam, could not work or get more than 50 per cent. of the cannel and black coal under the reservoir, or within 20 yards of its boundary; and I find that a prudent lessee, working without right to compensation, would be compelled, by reason of such apprehension of injury, to abstain from working or getting more than 50 per cent. of the cannel and black coal in their such last-named area."

Now, I think that, in order to bring the mine-owner in this case within the 25th section of the statute, the continuous working of the mines or minerals must have been "interrupted as aforesaid"—that is, manifestly under the 22nd section—"or by reason of such apprehended injury to the working as aforesaid." The 23rd and 26th sections, giving power respectively to the owner to work his mines, and to the undertakers to inspect the working of the mines after giving 24 hours' notice, show the complete scheme of the Act, I think, supplemented, perhaps, by 26 & 27 Vict., cap. 93, secs. 5 to 10 inclusive. I am not certain that the Act I have just referred to does not suggest that the Legislature had thought, from the experience of facts, that the undertakers of water-works were not sufficiently under supervision in respect of the security which other people were entitled to, and accordingly framed an additional code, by which danger to other people might be averted, and such undertakers be compelled to look to the safe condition of their reservoirs. But, dealing with the matter as it was left under the Act of 1847, each case of difficulty and interference with their respective rights appears to have been provided for, or intended to be provided for, by the sections under construction. Now, with one exception—viz., the apprehended injury (which it appears to me to be impossible to contend is not the same apprehended injuries throughout sections 22, 24, and 25)—the language of the 25th section is copied almost *totidem verbis* from section 81 of the Railways Clauses Act, where no such reciprocal danger on the part of the mine-owner could have arisen. I cannot, therefore, find, on the facts as set forth in the award, any danger which those sections contemplated as the subject of compensation. There is, as I have before remarked, all the difference between the principles upon which compensation ought in general to be assessed. [His Lordship proceeded to quote various cases bearing upon the points raised.] On the whole, I am unable to concur with the Master of the Rolls and the two learned Judges of the Queen's Bench in the view that any present injury now exists in respect of which the compensation claim is due. The mine-owner has not been stopped under the powers of the Act. No compensation, I think, for injuriously affecting can at any time be demanded under the 6th section, since I consider that all rights of compensation are exhaustively dealt with under the mining sections; and I think all sense of injustice to the mine-owner is relieved when one remembers that the decision is not one which finally determines the relations between the mine-owners and the undertakers. When the mine-owner does work—when an interference with the mining operations is actually made—then, I think, he will be entitled to litigate that question, and claim compensation; but until that contingency arises—and in my opinion it has not yet arisen—he has no claim. I consider the Arbitrator has very tersely and accurately stated the question—"Whether, by virtue of the Water-Works Clauses Act or of the Land Clauses Act, or otherwise, the claimants are entitled upon this arbitration to claim and to recover compensation for the prospective prevention of the working of more than 50 per cent. of the cannel and black coal within the defined area." It will be observed it is not present prevention from apprehension of prospective damage, but prospective prevention. This is a thing for which I think the Act makes no provision, for reasons which I have already suggested, and upon which I consider it unnecessary to enlarge. Under these circumstances, I am of opinion that the judgment of the Court of Appeal ought to be affirmed, and the appeal dismissed with costs.

The other noble and learned Lords concurred in the result of the Lord Chancellor's judgment, and the appeal was therefore dismissed.

The question of costs was reserved for further argument.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Tuesday, Dec. 16.

(*Before Mr. Justice* NORTH.)

Corporation of Wolverhampton v. Bilston Commissioners and Local Board of Health.

This was an action to restrain the defendant Commissioners from taking steps to supply their district, which is within the old parish of Wolverhampton, with water from any other source than the plaintiffs, in breach of a statutory agreement. The matter has already been referred to in the JOURNAL. Questions of law only were now argued; it being agreed by both parties that the questions of fact that were raised in the pleadings, relating as they do to the quantity and quality of the

water supplied by the plaintiffs, would become immaterial in case the law were decided in favour of the defendants. The agreement in question was dated May, 1866, and was made between the then Wolverhampton New Water-Works Company and the defendants. It was mutually agreed between the parties that the Company should supply the township of Bilston with water, and that the Commissioners should purchase such supply, on the terms thereinafter set forth, for the term of 14 years. The Company were to supply to the township daily 220,000 gallons of water at the least, and such further and greater quantity as the Commissioners might "take, use, and require." The water was to be of the usual good quality, and fit for all ordinary domestic purposes. The Commissioners were to pay for a daily supply of 220,000 gallons at 0·2d. per gallon, whether they used and consumed this quantity or not; and the Company were to supply at the same price any further quantity the Commissioners might require. The agreement was ratified by an Act of Parliament passed soon after it was made; and subsequently it was made perpetual by another Act. The powers and obligations of the Company were transferred to the Corporation; and, by the clauses of different Acts, provision was made for the application of the profits of the water-works for the benefit of the borough and the water consumers. The principal questions were whether, upon the construction of the agreement, the defendants were bound to take their supply of water exclusively from the plaintiffs as the successors of the Company; and whether, if they were, they were nevertheless empowered, by section 51 of the Public Health Act, 1875, to procure a supply elsewhere, and that, notwithstanding the provisions of section 52, which prevents a local authority from doing so if there is a water company having power to supply within their district. Upon this part of the case, it was contended that the Corporation were not a water company within the meaning of the definition clause in the Public Health Act—viz., "any firm or body of persons, corporate or unincorporate, supplying, or who may hereafter supply, for his or their own profit."

Mr. COZENS-HARDY, Q.C., Mr. A. UNDERHILL, and Mr. E. NOON appeared for the plaintiffs; Mr. F. MOULTON, Q.C., and Mr. UPJOHN for the defendants.

Justice NORTH, in an exhaustive judgment on the meaning of the contract as a whole, said, though the construction was not without difficulty, he had come to a clear conclusion in his own mind that the several words "use," "require," "take," and "consume," which appeared with respect to the water to be supplied, all meant the same thing—viz., the quantity of water needed throughout the defendants' district; and the Commissioners contracted to take all their supply from the plaintiffs. He also found that whether, apart from section 52 of the Public Health Act, the defendants would or would not have been empowered, notwithstanding their agreement, to get water from another source, the Corporation were a corporate body, supplying water for their own profit within the Bilston district; and therefore the Commissioners were prohibited, by the section named, from acting under section 51, so long as the plaintiffs were able and willing to supply them. The result was that he decided in favour of the plaintiffs on all the points of law raised.

SOUTHWARK POLICE COURT.—Monday, Dec. 15.

(*Before Mr.* SLADE.)

The South Metropolitan Gas Company Fined for Deficiency in Illuminating Power.

To-day, Mr. C. A. ROBERTS, from the Solicitor's Department of the London County Council, attended at the Court to prosecute in a summons taken out against the South Metropolitan Gas Company for supplying gas at one of the testing-stations of less illuminating power than the standard.

Mr. WASHINGTON appeared for the defence, and said his clients would plead guilty.

Mr. ROBERTS explained that the Company were required to supply 16-candle gas, but that when tested, the illuminating power was found to be 15·3 candles only. The penalty they had incurred was 40s.

Mr. SLADE fined the Company the amount named, with 2s. costs; an application for higher costs being refused.

The Gaslight and Coke Company and their Lamplighters.—A meeting of the lamplighters in the employ of The Gaslight and Coke Company was held last Tuesday evening, at the Athenæum Hall, Tottenham Court Road, for the purpose of tendering thanks to the Company for the generous concessions made by them to their employees during the past year. Mr. R. Woods took the chair. Mr. W. Wheeler assured the meeting that their employers thoroughly deserved any vote of thanks they might tender to them. Last summer, in response to a letter addressed by him to the men, the twelve delegates appointed by the men accompanied him to interview Mr. Young, asking for a week's holiday every year, and an increase of wages. The next step was the sending of a petition to the Directors, embodying the requests of the men. While this matter was being considered, the South Metropolitan Gas Company's men went out on strike; and Mr. Young asked him whether, in face of this, it was wise to persist in the demand. He replied that the demands were not made in any spirit of antagonism to the Company; and that the men had no organization. Mr. Young then instructed him to write to the Directors asking for a reply to the petition. A few days after, the reply was received by the delegates, stating that the Directors had decided to grant 1s. per week advance to the men, and a week's holiday every year. Mr. Wheeler then moved the following resolution, which was seconded by Mr. Goodwin, and carried unanimously, amid loud cheers—"That this meeting of the lighters in the employ of The Gaslight and Coke Company beg to tender their sincere thanks to the Managers and Directors for the generous consideration shown us in the granting of a week's holiday once a year and an advance of wages. That we fully appreciate such consideration as you have shown, and trust the good feeling which exists between us may long continue." It was agreed that the resolution should be engrossed and sent to the Directors.

MISCELLANEOUS NEWS.

THE POWERS OF GAS COMPANIES AS TO CUTTING OFF SUPPLIES.

The Proposed Amendment of Legislation.

In connection with our notices of the Bills to be introduced in the present session of Parliament in regard to the supply of gas and water, special mention was made of the fact that The Gaslight and Coke Company and the Brentford Gas Company were both about to take steps to settle definitely, as far as they are concerned, the law relating to cutting off supplies of gas; a misunderstanding in regard thereto having, as may be remembered, brought upon the latter Company the trouble of defending certain County Court proceedings and the payment of a fine of £15. The outlines of the measures which the Companies purpose introducing have already been indicated; but, as the Bills have now been printed, the exact nature of the changes proposed to be effected in the existing legislation can be stated.

The Gaslight and Coke Company's Bill is to confer further powers on the Company, "to remove doubts," and for other purposes. The preamble sets forth that the Company are authorized by provisions in various Acts of Parliament to stop the supply of gas, in certain events and subject to certain conditions, from entering the premises of persons supplied by them, by cutting off the service-pipe, or by such means as they shall think fit; and to remove from such premises the meters, pipes, and other fittings, the property of the Company. As doubts have been raised as to the construction of these provisions, as well as the rights and powers of the Company acting in exercise thereof, it is considered to be expedient to put an end to them; and as it is for the public benefit and convenience that the Company should be enabled so to exercise their powers as to avoid all unnecessary breaking up of, or interference with the streets, roads, and footways within their limits of supply, they ask Parliament to sanction the proposals of the Bill. There are only three clauses, the first of which gives the short title of the Act, which is to be cited as "The Gaslight and Coke Company's Act, 1891;" and it is to incorporate the Company's Act of 1868, and all the Acts incorporated with or amending it. The second clause, providing for the entry on premises to cut off supply, is as follows:—

Notwithstanding anything contained in the Gas-Works Clauses Act, 1847, the Gas-Works Clauses Act, 1871, and the Special Acts of the Company, or any or either of those Acts, whenever a consumer of gas supplied by the Company ceases or has ceased to require or to take a supply of gas from the Company, or neglects to pay the rent due for the same, it shall be lawful for the Company, their officers or servants, after twenty-four hours' notice in writing, to enter between the hours of nine in the morning and four in the afternoon the premises supplied with gas by the Company, or from which the supply of gas is to be taken away or cut off, for the purpose of disconnecting or stopping the supply of gas to such premises, and to disconnect or stop such supply by cutting off or disconnecting the service-pipe or the pipe through which the gas was or is supplied, at the meter or elsewhere, or by such other means as the Company, its officers, or servants may think fit; but in so doing the Company, its officers, agents, workmen, or servants, shall do no more damage than is reasonably necessary. Any such notice as aforesaid shall be sufficiently authenticated and sufficient if signed by the Company's Secretary, officer, or servant (as the case may be), or bearing his name or signature, printed, lithographed, stamped, or engraved thereon. And any such notice may be served, and the service thereof proved, as provided by section 136 of the Companies Clauses Consolidation Act, 1845.

The third clause simply provides for the payment of the costs of the Act.

The Brentford Company's Bill also consists of a preamble and three clauses only. The former sets forth that the Company have incorporated in their Special Acts the Gas-Works Clauses Acts of 1847 and 1871; and that their proceedings are thereby regulated. It then goes on to cite the provisions of those Acts bearing upon the subject of cutting off a supply of gas, in the following terms:—

The Act of 1847 (clause 16) provides that, when any person supplied with gas neglects to pay the rent due for the same to the undertakers, "the undertakers may stop the gas from entering the premises of such person," "by cutting off the service-pipe, or by such means as the undertakers shall think fit;" and by the Statute Law Revision Act, 1875, certain other provisions of the said Act relating to the same matter are repealed, and the Act of 1871 (clause 22) re-enacts certain other provisions in lieu of those repealed, which are as follows: "That in all cases in which the undertakers are authorized to take away and cut off the supply of gas from any premises, it shall be lawful for the undertakers, their agents, or workmen, after 24 hours' notice in writing under the hand of the secretary or other properly authorized officer of the undertakers to the occupier," "to enter such premises between the hours of nine in the morning and four in the evening for the purpose of removing and to remove such pipes, meters, fittings, or apparatus, repairing all damage caused by such entry or removal."

It is then pointed out that cutting off the service-pipe as prescribed by the Act of 1847 necessitates taking up the roadway or pavement, and thereby causes great interruption to the traffic in the public streets and thoroughfares, and an expense in paving, labour, &c.; and that the same expense has to be repeated on the supply being renewed. Since the passing of the Act of 1871, whenever it has been necessary to discontinue the supply, the Company have regulated their proceedings by clause 22 of that Act, and have entered the premises, removed the meter, and capped the service-pipe; thereby avoiding the interruption of the traffic and the expense of paving, &c. Doubts have recently arisen as to whether this practice is within the true interpretation of these Acts; and, as already intimated, the object of the Bill is their removal, and the clear definition of the Company's powers in this respect. This it is proposed to do by the following clause:—

Notwithstanding anything contained in the 16th section of the Gas-Works Clauses Act, 1847, or the 22nd section of the Gas-Works Clauses Act, 1871, when any person supplied with gas neglects to pay the rent due for the same, it shall be lawful for the Company, after giving twenty-fours' notice to such person, to stop the supply, and for that purpose to enter the premises where the gas is supplied, by their agents or workmen, between the hours of nine in the morning and four in the evening, and stop such supply by such

means and in such manner as they think fit or circumstances render necessary, but so as in all cases to avoid as far as practicable any obstruction to public traffic by opening the streets, and at the same time to remove any meter, pipes, fittings, or apparatus used for the purposes of such supply, and belonging to the Company. And every such notice as aforesaid shall be signed by the secretary or other duly appointed officer of the Company, and may, together with the signature, be partly in writing and partly in print, or wholly in either one or the other; and all such notices may be served personally or by post, addressed to the premises to which they relate, in manner and subject to the regulations prescribed in the 136th section of the Companies Clauses Act, 1845.

THE COST AND SALE OF GAS IN EDINBURGH AND GLASGOW.

The Edinburgh and Leith Corporation Gas Commissioners, considering the discussions and objections in various quarters with reference to the increased price and the quality of the gas supplied throughout the district, instructed their Engineers to prepare statements showing the gas manufactured, with the cost of coal, wages, and other manufacturing and distributing charges at their works in Edinburgh and Leith.

Mr. Frederick T. C. Linton, the Engineer of the Leith works, recently submitted a statement dealing with the Leith works in the period from the 15th of May, 1869, to the present time. It shows that the quantity of gas made in 1869-70 was 221,079,000 cubic feet, as compared with 425,622,000 cubic feet in 1889-90. The percentage of gas unaccounted for in 1869-70 was 21·55, compared with 7·63 per cent. in 1887-88—the last year the returns could be made up to, the mains from the two works being coupled up after that time. The price of gas in 1869-70 was 4s. 6d. per 1000 cubic feet, and the candle power 31·38, as compared with 3s. 6d. and 27·77 candles in 1889-90. The average price of coal per ton in 1869-70 was 15s. 4¾d., as compared with 11s. 9¼d. in 1889-90. During the twenty years, the highest price of gas was in 1873-74, when it was 6s. per 1000 cubic feet; while the average price of coal was 22s. 11d. per ton. The total cost of coals, manufacture, and distribution in 1869-70 was equal to 22·75d. per 1000 cubic feet of gas made; while in 1888-89 it was equal to 18·43d. per 1000 feet made, and in 1889-90, it was equal to 22·12d. Under the head of repairs, maintenance, and renewal of mains, service-pipes, and meters, the cost in 1889-90 was equal to 3·24d. per 1000 cubic feet of gas made, as compared with 1·24d. the previous year; being an increase of 2d. per 1000 cubic feet. This is explained as being due partly to the rise in wages, but mainly to the extra workmen employed, and materials used, in connection with the re-arrangement of mains, service-pipes, and meters consequent upon the transfer and the re-arrangement of the areas of supply. The present arrangement is that all north of the line of George Street belongs to the Leith works, and all south of that line to the Edinburgh works. The hourly rate of wages in 1869-70 was, for retortmen, 4·14d.; barrowmen, 3·14d.; yardmen, 3d.; while in 1889-90 it was, for retortmen, 7½d.; barrowmen, 6d. to 7d.; yardmen, 5d. The average price of coal per ton for the last contract was 11s. 2½d.; and the estimated average price per ton for 1890-91—taking into account the stock on hand at May 15, 1890, is1 5s. 9½d.—an increase of 4s. per ton. The estimated total cost of gas per 1000 cubic feet in the year 1890-91, taking into account the cost of coal, manufacture, and distribution, was 29·22d., compared with 22·12d. the previous year. If the former candle power had been maintained, the estimated extra price of coal would have been 6s. 7d. per ton, or about 7·9d—per 1000 cubic feet of gas made. The average candle power from May 15 to Oct. 31, 1890, has been 25·78, as compared with 27·77 candles last year. From these figures it appears that, compared with the year 1888-89, there is an increase in cost of nearly 11d. per 1000 cubic feet of gas made, even with the reduction of 2-candle power; and that, had the Commissioners elected to keep up the former candle power, with the enormous advance in the cost of parrot coal, the increase in the price of gas would have been equal to 17d. per 1000 cubic feet. The increase upon the price of gas which the Commissioners have imposed for the current year is only 3d. per 1000 cubic feet. It further appears that the charge for meters was equal to about 2d. per 1000 cubic feet of gas sold. It is to be observed that there is to be added to the total cost of coal, manufacture, and distribution as stated, the cost of inspectors for reading meters, the collection of accounts, and the office charges, including the salary of the Treasurer and Clerk, as also taxes and repairs, besides the annuities to the shareholders of the old Companies, with interest upon borrowed money, and the sinking fund, also discounts, bad debts, and reduced rates for the public lamps.

A similar return is being prepared by Mr. R. Mitchell, relative to the Edinburgh works.

The following particulars relate to the great increase in the consumption of gas in Glasgow and its suburbs since the Corporation took over the works and interests of the Glasgow Gaslight Company and the City and Suburban Gas Company in the year 1869. The quantity of gas sold during the first year of the operations of the Gas Trust was rather over 1000 million cubic feet; and the revenue was about £225,000, out of which there was allowed as discount about £10,000. The price at that time was 4s. 7d. per 1000 cubic feet. During the last financial year (1889-90), the quantity of gas sold was 2753 million cubic feet, and the price was 2s. 6d. per 1000 feet; no discount being allowed or meter-rent charged to the consumers. The Glasgow Gas Trust now stand sixth on the list of the great gas-supply undertakings of the United Kingdom, and third in respect of the gas concerns owned by Corporations—those of Birmingham and Manchester being greater in extent. In the Glasgow area of supply there are 134,215 meters in use, as compared with 54,998 in Birmingham, and 78,114 in Manchester, from which it may be argued that greater advantage is taken of the gas supply in Glasgow by the occupiers of small houses than is the case in the great English towns mentioned. Regarding the public lighting within the burgh of Glasgow, as carried on under the control of the Police Commissioners (who, under another name, also have charge of the municipal gas-supply undertaking), including the public and private streets, courts, &c., there are about 13,000 lamps, which receive daily attention from the Lighting Department. In certain special cases there are as many as four burners in each lamp, which collectively consume as much as 20 cubic feet of gas per hour. Then in the closes and common stairs, there are about 29,800 lights, which are likewise looked after by the same department. These lights are 3-inch rat-tail flames consuming $\frac{7}{10}$th cubic foot of gas per hour. There are 254 stair lighters, whose wages range up to 14s. per week; and the lamp-lighters for the streets, courts, &c., number 112. These men are paid up to 22s. per week, in addition to which they receive a suit of uniform, with an extra pair of trousers per annum, and an overcoat every second year. For the financial year commencing June 1, 1890, the estimated expenditure of the Lighting Department is set down at £43,173; the amount of gas to be consumed being estimated at 201½ million cubic feet, at the cost of 2s. 6d. per 1000 feet. Last year the actual expenditure amounted to £43,172.

CONTINENTAL UNION GAS COMPANY, LIMITED.

The Ordinary General Meeting of this Company was held last Tuesday, at the London Offices, No. 7, Drapers' Gardens, Throgmorton Street, E.C.—Mr. H. M'Lauchlan Backler in the chair.

The Secretary (Mr. F. W. Himing) read the notice convening the meeting, and also the following report of the Directors for the year ending June 30 last:—

The Directors have to report to the shareholders that at Messina and Montargis (the two stations belonging exclusively to the Continental Union Gas Company) there has been a net increase of 20 public burners, and of 279 additional private consumers.

The outlay on capital account at these stations from July 1, 1889, to June 30, 1890, has been £2010. At Messina, additional scrubbing power, a new foul main, condenser, and exhauster have been provided at the works, as also new mains, lamps, and service-pipes in the town. At Montargis an additional exhauster has also been supplied.

The outlay on capital account at the thirteen stations the property of L'Union des Gaz amounted for the year to £64,200 for additional buildings, apparatus, mains, service-pipes, and lamps required on account of the continually increased quantity of gas supplied.

The reduction of price at Alessandria referred to in the last report, consequent on the extension of the concession, has continued to have a very marked effect in increasing the quantity of gas sold at that station.

At Rueil the mains have been extended as far as the Communes of La Celle, St. Cloud, and Vaucresson.

The dividend receivable on the Continental Union Gas Company's investment in the Union des Gaz is the same in 1889-90 as in the previous year.

The following information relating to the working of that Company's stations is given as usual: The net increase in the number of private consumers during the year 1889-90 was 3999; but the number of public lights shows a decrease of 172.

The quantity of gas sold shows an average increase of 5 per cent. The cost of coals per ton was nearly 2s. more than in the previous year. The total amount of bad debts incurred and written off was only £550. The average price received for coke is about 1s. 3d. per ton more; while that for tar shows an average decline of 8d. per ton.

The Union des Gaz accounts show that that Company has placed a further sum of £25,000 to special reserve, which now amounts to £72,400; and after payment of a dividend at same rate as previous year, they carry forward an undivided balance of £33,113. These amounts, together with the total statutory reserve and sinking fund, have all been reinvested from time to time in new works at the various stations.

After making the usual charges and reserves, the net profits of the Continental Union Company for the year amount to £116,478 18s. 10d.

The available sum to the credit of general revenue is £154,444 6s. 9d., out of which the Directors recommend a dividend at the rate of 13 per cent. per annum on the ordinary shares. The holders of 7 per cent. preference shares participate *pro ratâ* in all ordinary dividends exceeding 10 per cent.; and will therefore receive 10 per cent. for the year.

After deducting the interim dividend, paid in July last, of 5 per cent. on the ordinary, and 3½ per cent. on the preference shares, the balance of 8 per cent. on the former and of 6½ per cent. on the latter, all free of income-tax, may be paid on the 3rd of January next. The amount carried forward to the new account will then be £39,908 10s. 9d.

The Director who retires by rotation is H. Solomon, Esq.; and the Auditors (Alfred Hersee, Esq., and A. T. Eastman, Esq.) also retire. All being eligible, will be proposed for re-election.

The Chairman, in addressing the shareholders, said he had expected to be able that day to bring to a conclusion the matter for which they were called together twice in the autumn—that was, the consolidation of the shares of the Company into stock; but although the Solicitor had encouraged the Directors with the hope that the business might be completed at this meeting, it was still before the Courts. There was no difficulty that he (the Chairman) was aware of in carrying it out; but the delay of the law was proverbial, and it was owing to that delay they were unable to hold the extraordinary meeting at the close of the present one, to pass the necessary resolution. He expected, however, it would be done very shortly; and then, instead of shares, they would have nothing but stock—the £14 paid shares being consolidated with the paid-up shares into one class of stock, and the preference shares would be consolidated into preference stock of equal value. Referring to the report, he said they had very little to communicate with regard to the two stations of the Continental Union Gas Company—that was Messina and Montargis. They had made fair progress there. The consumption had increased at the rate of 5 per cent.; and they had done as well as they could expect to do in times of trial and, he might say, of difficulty, in Italy. In the Union des Gaz the progress, in the aggregate, had been the same as in their own case. The increase of consumption had been throughout the year at the rate of 5 per cent., which, he thought, was very good in present times, when, they found, gas consumption did not develop in the same proportion as it did formerly. They had had a drawback in the price of coal, which had been 2s. more than in the previous year. But they had contracts running, of which they had availed themselves to lay in as much of their supply as they possibly could on reasonable terms; and they had not had a very large proportion of that stock in expensive coals. He mentioned with regard to their old contracts that they would all expire on the 31st of this month, after which the whole of the coal which they received would be at a higher price than they had been paying on an average. They had found, on the part of their coal contractors,

a desire to fulfil, with only one exception, in the most honourable manner, the contracts entered into, though some said that they had been supplying the coal at losing prices. It was very pleasing indeed to find this spirit prevailing in the coal trade, with the exception to which he had referred; and in regard to that, he thought it would be sufficient to say he was afraid they would not be able to obtain what they considered to be their right without having recourse to law proceedings which they would take if necessary. As a set-off for the additional cost of coal (2s. per ton), they had realized 1s. 3d. per ton more for the coke they had sold. It must be borne in mind that the rise in the price of gas coal had been in a much larger proportion than the general rise in house or ordinary coal. This, he supposed, was owing to the smaller quantity of gas coal that existed, and the enormous demand which continued, notwithstanding the efforts of the electric light people to take away their customers. Tar and ammoniacal liquor had also improved during part of the year to a certain extent—not largely, but still enough to help them in bearing the additional cost of coal. In the Union des Gaz they had spent £64,000 for new works. An increase of 5 per cent. in the consumption of gas necessitated additional works now and then; and as long as this growth continued in the important towns which they lighted in Italy, France, and Germany, they would have to expend capital in extending and enlarging the works. They had done this in the narrowest possible limits. The shareholders had all recently received a circular respecting a loan which the Union des Gaz had contracted—that was, £60,000 in obligations, at 4½ per cent. He was glad to say there was no difficulty in raising the whole of this money, which would be applied for the purposes of outlay; so that they would find their capital raised at 4½ per cent., and he believed the money they spent would yield a much larger profit than this. The position of the Union des Gaz was, as he had always informed the shareholders, an excellent one. During the past year, they had taken out of profits and added to the reserve funds (which, it was true, existed in that Company on paper, because the money had been invested from time to time in new works, but still they had the value in the additional works.) The increase of the amount allocated during the past year was £42,125; and the total of the reserves now amounted to £465,767 —being nearly half of the whole of the paid-up share capital of the Union des Gaz. It would have been noticed that in the report it was stated there had been a decrease in the public lights of 172. At the last meeting, he alluded to the reason for this. The electric light had taken the place of many of the public lamps which the Company formerly supplied; and the reduction was accounted for in this way. The electric light was making more or less progress in some of the towns they supplied with gas—he should say rather less than more, except perhaps in Milan, where there was really a great deal of electric lighting. But the shareholders of the Union des Gaz need not be alarmed at this, because it was a fact that during the first fortnight of this month, it was found that the consumption of gas exceeded the maximum which had ever been previously attained at the Milan works. Returning to the Continental Union Gas Company, he said that they possessed 37,000 shares in the Union des Gaz out of the 50,000 shares of which the capital consisted. Last year in an estimate he made, and which he laid before the shareholders, he took the value of these shares (which were nominally £20 shares) at £56 each. But they had recently been "done" on the Paris Bourse at £64, or a fraction lower; and at the present time this figure might be obtained for them. The Board had been somewhat tempted to sell a portion of the shares; but seeing the excellence of the investment, they made up their minds not to do so at present. However, if thought expedient, they might do so at some future time. He valued the shares this year at £60, so as to be well within the mark; because the shareholders knew how difficult it would be to part with any number of shares in any undertaking without reducing the price, unless the transfer, were made very gradually, which it would be the policy of the Board to do should they part with any of these securities. Now, taking the shares at £60, the Company's investment in the Union des Gaz showed an improvement in the value at which those who operated on the Paris Bourse placed them, of £148,000; and it brought up the present value of the 37,000 shares to £2,220,000, while they cost the Company only par—that was £740,000. The difference was a clear profit on the investment, if they were to realize at the price mentioned at the present time. He thought the shareholders had reason to congratulate themselves on the continually improving position of the undertaking. They had, as he had said, a drawback in the increased price of coal; but they looked to the advanced price of coke to compensate them in part for that additional cost. When they came to consider the improved value of their property in the Union des Gaz, the good and steady business which had been done at their own two stations, the increase in the consumption of gas (which was constant, and which was greater than in most other gas undertakings at the present time), and all the other circumstances surrounding the Company which were of a favourable character, he thought they might congratulate themselves in being in such a position in this investment, which was, in fact, the mainstay of the concern. Just what the cost of coal would be in the future, he could not tell; but this was a diminishing evil, because the price was being gradually reduced, and was considerably less now than it was a few months ago. The policy of the Board was to make short contracts when coal was high in price —as short as they could prudently and reasonably do; and then when they fell in value, they were quite ready, if they could do so, to make long contracts, because that was an advantage which they had realized during the past three years. The contracts which expired at the end of this month, and which were made three years ago, had saved the Company from a very large loss, which they would have sustained, if they had continued to make short contracts, in trying times. The reserves in both Companies were large; and those in their own Company were in actual securities, which could be realized at any moment. The Board were in the position of being able to recommend the same dividend which had been paid during the past two or three years—that was 13 per cent.; and they would pay it a day sooner in January, that was on the 3rd, instead of the 4th, as the 4th fell on a Sunday. He concluded by moving that the report and accounts be received and adopted.

Mr. H. WOLLASTON BLAKE seconded he motion.

Mr. SPARKES remarked that he did not see what would be the object of selling any of the Union des Gaz shares. If they sold them, they would probably have to invest the money in 3 per cent. stock; while they were doing much better in the Union des Gaz.

The CHAIRMAN said that, when the Directors considered the matter, it certainly did seem a great temptation to sell the shares at the price then quoted—a price which might not always be obtained; but they resisted the temptation, because they did not exactly see what they would do with the money. When they saw that they could employ the proceeds to advantage, and the shares were fetching such a high price, he thought they would sell a portion of them; but at the present time it was not their immediate intention to do that.

The motion was unanimously carried.

On the proposition of the CHAIRMAN, seconded by Mr. E. GAREY, Mr. H. Solomon, the retiring Director, was re-elected.

The CHAIRMAN moved that a dividend for the year ended June 30 last, at the rate of 13 per cent. on the ordinary shares, and of 10 per cent. on the preference shares, be declared payable on Jan. 3.

Mr. R. HESKETH JONES, in seconding the motion, observed that he had casually looked into the accounts; and he saw that their earnings had been £1900 in excess of the amount of the dividend they were then declaring.

The motion having been passed,

The Auditors (Messrs. Hersee and Eastman) were re-appointed, on the motion of Mr. R. H. JONES, seconded by Mr. HOOKE.

A vote of thanks was then passed to the Secretary, Managers, Engineers, and officers of the Company and the Union des Gaz for their services during the year; the CHAIRMAN, who proposed it, remarking that it was impossible to carry on an undertaking like theirs without very efficient officers, and they richly deserved the thanks of the proprietors.

Mr. I. A. CROOKENDEN moved a vote of thanks to the Chairman and Directors for the manner in which they had conducted the business of the Company during the year. He said the statement made by the Chairman, which was always so interesting to them, had been particularly so that day; and it was a matter for sincere congratulation that they were as they were. He differed from the Chairman a little in respect to the matter of the increased price of residuals. As compared with the cost of coal, he thought the prices obtained (from coke especially) were really most excellent. He could not help thinking—having himself known a little about gas manufacture in the past—that if all gas companies ran as close to the increased cost of coal as they had done, in realizing higher prices for residuals, they would have little to complain of. He also considered it a matter for congratulation that, amid all the clamour for electric light, their Board had not been seduced by that wonderful flicker. It seemed to him that a great mistake had been made elsewhere in regard to this matter; and he hoped their own Board would set their faces against coquetting with the electric light. He felt confident that, as time went on, gas—so clean, so inexpensive, and so economical in every way—would be more and more applied for the purposes of cooking and heating. The Directors, he hoped, would adhere to their policy, and let the electric light fight its own way, as he was sure they would always be able to compete with it. In conclusion, he observed that their Chairman had the sincere congratulations of the shareholders in being in such good health, as they had heard rather sorrowful accounts of Mr. Backler of late. It was largely owing to the policy of the Chairman that they were in such a successful position that day.

Mr. SHORTHOSE seconded the [motion, which was unanimously carried.

The CHAIRMAN, on behalf of himself and colleagues, cordially thanked the shareholders for their resolution, and especially for the flattering terms in which his name had been mentioned. They were, he said, a real working Board; and it was their determination to do their utmost to secure as satisfactory results in the future as they had done in the past.

The proceedings then terminated.

The Campbell Gas-Engine Company, Limited, have opened a show-room and office at No. 111, West George Street, Glasgow, the management of which has been entrusted to Mr. James Campbell.

The Price of Gas at Nottingham.—At the last meeting of the Nottingham Town Council, a memorial from gas consumers was read, in which it was contended that the Council did on July 7 last take an unlawful course in raising the price of gas in such a manner that the increase came into operation from June 24—the quarter day preceding. It was agreed to refer the memorial to the Chairman of the Gas Committee. Writing on the subject in a local paper, a Mr. Slack makes the following remarks, which show that the memorialists are not going to let the matter rest: "Two members of the Gas Committee (neither of them being the Chairman or Vice-Chairman) have said in reference to the memorial that 'the Committee have the power of advancing the price, and that they did on June 12 last make the increase; and thus gave notice of the coming advance.' As mentioned in the memorial, the Committee on June 12 'recommended' that the Council should increase the price from June 24. On July 7 Mr. Alderman Barber proposed in the Council Chamber—'That an advance in the price be made commencing on June 24 last, as recommended in the Committee's report.' If the Committee had the power to advance, it was surely not necessary to ask the Council to make the increase. Alderman Barber said, at the Council meeting on July 7 last, that 'the Committee do not raise the price of gas.' Your readers being aware that they do not, will be much astonished that any member of such Committee should claim a power they do not possess. Another memorial, which will include the following sentence, will be presented to the Council at the next meeting: 'Your memorialists cannot believe that the Council will agree with the opinion held by the two Committee-men referred to; and it is expected, as a matter of right, that the resolution of the 7th of July will be so amended that the increase does not come into operation prior to Michaelmas, 1890, and also that the twopences wrongfully and illegally demanded and received for the quarter from Midsummer to Michaelmas shall be deducted from the Christmas accounts.'"

THE WATER-GAS INDUSTRY.

In the JOURNAL last week, brief mention was made under this heading of meetings of the British Water Gas Syndicate, the Yorkshire Water Gas Company, and the North British Water Gas Syndicate; and we now give extended reports of the proceedings thereat.

British Water Gas Syndicate.

The First Annual Meeting of this Syndicate was held last Friday week at the Great Northern Hotel, Leeds. In moving the adoption of the report, the Chairman (Mr. Samson Fox) gave an outline of what had been done since the statutory meeting on May 14 last year. He said they had had considerable difficulty with one of the subsidiary Companies—the Notts. and Derby—and the minds of their friends in the North British Company had been somewhat affected by it. The difficulty with the latter was ultimately put right by the Syndicate giving more territory and taking instead of cash more shares. The balance-sheet showed £69,000 owing to the Syndicate on that account; but £29,000 had since been paid up. The Yorkshire Company had been working very hard in spite of their difficulties, which mainly consisted of managing to get the right people in the right place in connection with the working of the business. The Yorkshire people had felt that they also should have an increase of territory; and the Syndicate had accordingly granted them Lancashire. The Syndicate had also been pushing their way to obtain work, and times were favourable for it; for water gas was believed in now by thousands of people, who at the time he last spoke upon the question in London could not credit what was said. There was only one matter mentioned in his speech at that time which it had not been possible to carry out. It had been thought that it would not be right to endeavour to start any more concerns for the manufacture of water-gas plant; and it was decided that those gentlemen who had contracts should, in the interests of their own common sense, relinquish their rights to those contracts, and it was agreed that these contracts should be annulled for the reason that the time was inopportune. He was pleased this was so, because the Syndicate had all the rights and powers of going forward into various parts of the country and dealing with the questions of being able to sell right and left such licences as might be required. The Chairman proceeded to speak of the way in which the utility of water gas as an illuminant had been demonstrated by the Syndicate; and he mentioned that no fewer than 47 inquiries on the question had been received since last September. He remarked that they had now all the powers by which they could take any existing gas-works, and, without interfering with anything but the retorts, could turn them into a water gas plant, which would do the same work as the present plant, while where 200 men were now employed to produce a certain amount of coal gas per day, the Syndicate could undoubtedly do the work with about 40 men. By this means he said it would practically be impossible for any combination of gas workers to interfere with the gas supply; while at the same time an equal quantity and quality of gas would be produced. Speaking of his visit to the United States, the Chairman dwelt upon the extent of water-gas manufacture in Brooklyn, New York, Chicago, and other places. In Chicago, he observed, there were 42 miles of pipes; and there had not been a single fatal accident, although no odorizing agent was used. The question of odorizing water-gas, he added, had been most successfully mastered by the Syndicate. At present in the United States they were making more water gas in twenty-four hours than the whole gas lighting of this country consumed at the present time. With regard to the use of water gas for manufacturing purposes, he went on to mention instances of its successful application for singeing, welding, making glass bottles, and so on, at Newcastle, Lancaster, Castleford, and Todmorden. As to the convenience of the piping required for street lighting by water gas, he said a test had been made by which it was proved that, through 600 yards of ½-inch pipe, 25 street lamps could be kept alight at a cost of about 2d. per yard of pipe. This thickness of tubing could easily be pinned to the wall; whereas the pipes required for coal gas necessitated conveyance under the roadway. As to the success of water gas, Sir Henry Roscoe's opinion was that there was no doubt about it, and that the Syndicate was on the right track. He (the Chairman) held 4750 shares, which cost him £50,000; and he intended to stick to the thing, and prove that water gas had a great future before it. The motion having been seconded, Mr. Hyde put a number of questions to the Chairman, who elicited that his interrogator was a Solicitor, representing certain members of the Stock Exchange. Not being a shareholder, he refused to reply, and requested him to leave the room. This Mr. Hyde did; remarking that proceedings would be taken in reference to the acts he had referred to. A complaint was then made by Mr. Brooks that there were no results at present; and he added that he should like to hear Sir Henry Roscoe's report read, for he noticed that Sir Lowthian Bell did not believe in water gas. The Chairman read a summary of Sir Henry Roscoe's opinion, which was to the effect that (1) water gas was a valuable agent for commercial purposes; (2) it could be produced at a cost of 4d. to 6d. per 1000 cubic feet; (3) as an incandescent light it was whiter, steadier, and purer than an ordinary coal-gas flame, and was also smokeless, while other advantages were the rapidity with which it could be produced, the diminished cost of labour, and the small cost of the plant. With regard to what Sir Lowthian Bell had said, the Chairman observed that he did not think that gentleman could repeat what he had said at Paris, and, able man as he was, he would not learn what was to be learned about water gas. Mr. W. F. Bently said he could not see any cause for congratulation on the report. He thought the Directors were to blame for having led the public to put such confidence in the project; and he moved, as an amendment, that a Committee of Investigation be appointed. He also expressed the opinion that, as the net profit was only £1600, the Directors might have waived their claim to the £4000 for fees and expenses. The amendment was seconded by Mr. Brooks; but on being put, only five hands were held up in favour of it; and the substantive motion was then adopted. The bonus of 5 per cent. was agreed to.

Yorkshire Water Gas Company.

The Annual Meeting of this Company was also held last Friday week at Leeds—Mr. J. Mitchell (who is the Deputy-Chairman of the British Water Gas Syndicate) presiding. The Chairman moved the adoption of the Directors' report, in which they stated their regret that there had not been a larger amount of business done. It was anticipated that the year's work would have given a more successful result. But, like all new companies that have a novel business to develop, this Company had had to contend with a large amount of opposition and prejudice; and it was not until very recently that manufacturers (except the Leeds Forge Company) were induced to adopt gaseous fuel in their works. In August last a plant was erected at Harrogate for the purpose of demonstrating the value of water gas as a street illuminant; and this installation proved successful in every respect. The Company were now in treaty for the erection of three water-gas plants for illuminating purposes. The Directors also called the special attention of the shareholders to the great increase in the value of the property of the Company, by the acquisition of the rights of Lancashire conveyed to them by the parent Company free of charge. Mr. G. Whitehead, in seconding the motion, observed that no company had been harassed more than theirs, both from within and without. He did not mean to say that Directors and shareholders had given any immediate trouble; but what he did say was that from the prejudices and ignorance that prevailed in regard to the Company's patent, there had arisen in the minds of many shareholders difficulties that ought never to have been created. Mr. Watson Dyer said he would like the Chairman to make quite clear a few points in the report and balance-sheet, which, he thought, ought to have a little more light thrown upon them. In the first place, he would like to know whether it was not the British Water Gas Syndicate that had derived the benefit of the adoption of the water-gas system at Messrs. Spencer's steel-works at Newburn, and not the Yorkshire body? It seemed to him that the Yorkshire concern was little more than a sort of commission company for the British Water Gas Syndicate, and that its business was to "hawk" the parent Company's patents through Yorkshire. Surely £1340 as Directors' fees was an exceptionally heavy item for the work the Company had done; and yet to this was to be added a further £418 as Directors' expenses. In this way the Directors had, he contended, become entitled to a very large share of the whole of the Company's turnover, without showing anything whatever for it. Then again, it appeared that the Directors in May last had purchased £20,000 worth of shares from the British Water Gas Syndicate. With regard to this transaction, he thought, if the Company's position were to be analyzed, the Directors had not such an amount as that with which they might purchase the shares. This being so, he had taken Counsel's opinion on the legality of the transaction; and after hearing that opinion, had resolved, on his own responsibility, to take legal proceedings, and had had a writ issued against the Directors to test the case. In reply, the Chairman said that it was the British Water Gas Syndicate that had derived the benefit from Messrs. Spencer's works at Newburn. With regard to the purchase of the £20,000 worth of the shares from the parent Company, he was not prepared on that occasion to make any statement. Mr. Dyer had served them with a writ; and the issue being pending, caution was advisable, and he was consequently debarred from saying anything whatever in connection with it. The Directors' fees and expenses were for a period of about sixteen months. Mr. Chadburn pointed out that there seemed to be an impression abroad that the Company's patent was not the most successful; and as an instance of this, he referred to some works in Sheffield which had adopted a water-gas process, but not that owned by their Company. Mr. Samson Fox said he had had the highest opinion from men in this country and in America that the patent in the possession of the Company was the only one by which pure water gas could be made. There was no question, he thought, as to the excellence of the patents. What was required was their adoption by towns and villages, and so render profit to the Company on the sale of licences and royalties from those using the water gas. That was the business for which the Company was formed. The Castleford Glass Works and the Lancaster Waggon Company had, among others, already adopted the plant; and seeing that the Company had been in existence only twelve months, he asked them to show some consideration for the work that was being done. America had adopted water gas almost entirely; and as showing what an advantage it would be under such exceptional circumstances as those which had led to the Leeds gas riots, he said that sufficient gas might have been made to supply the borough by about 40 men instead of between 300 or 400. He had the greatest hope as to the ultimate success of water gas. The motion was then carried, with four dissentients.

North British Water Gas Syndicate.

In last week's issue, an epitome was given of the report which had been issued by the Directors of this Syndicate, on the operations of the Company from the date of its incorporation to the 29th ult. This report was presented at a meeting of the shareholders at Glasgow yesterday week by the Chairman (Mr. J. Reid Stewart); and in moving its approval, he expressed his sincere regret that the Directors could not lay before the shareholders a more satisfactory balance-sheet than that which they had to submit. As they were aware, Messrs. Spencer, the eminent steel makers, were erecting entirely new works at Newburn; and the Directors, after much trouble, succeeded in arranging with them to introduce water gas in the manufacture of steel at these works, which was duly contracted for, and had been fitted up and completed ready for work. Although the process had been energetically brought under the notice of steel makers, tube makers, and other manufacturers, the Board had found it practically impossible to induce any of them to put down a plant until the result was known of the experiments on a large scale at Newburn. It would be noticed from the report that the modification of the original agreement with the British Water Gas Syndicate, by which the Directors secured that £100,000 of the capital of the Company should be converted into deferred shares, receiving no dividend until the ordinary shareholders had had in all 50 per cent. of dividends, had now been carried out. If, therefore, the coming year brought more success to the Company, the amount on which they had to pay dividend was very materially reduced. With reference to the profit and loss account, the shareholders would observe that, in the peculiar circumstances, the Company had done almost no business, and the profits consisted chiefly of interest on bank

account; but, fortunately, this had been sufficient to meet the current expenses—leaving a balance to credit of profit and loss of £64 9s. 10d. This balance the Directors recommended should be carried forward till next year. Mr. Samson Fox, in seconding the motion, said the Company had been in existence something like a year and a half; and he could not boast of having had a very quiet time—from causes not connected with the introduction of water gas or the manufacture of plant. It had been one turmoil from beginning to end. He felt that those owning water-gas shares had been their own worst enemies. If they had been quieter, and had left alone those who really had the largest amount of money at stake, and who were working honestly and heartily to bring the undertaking to where it was promised to be brought, they would have got on a good deal faster. There were now ten sets of water-gas plant either at work or being constructed in different parts of the country. In Scotland they had been working at the Uddingston works, where the plant was manufactured for the British Company; the whole of the foundries and workshops and the Caledonian Railway Station close by being lighted with water gas. They supplied the gas to the railway at half the price charged by the coal gas company, and yet had a profit; and he had a letter from the General Manager of the railway, saying that "they considered that the lighting of Uddingston Station with water gas had been quite satisfactory." He (Mr. Fox) was certain that there was more in water-gas than they had ever supposed. He had been the more convinced by what he had seen in America, where water gas was so largely manufactured that they could hardly find coal gas. A shareholder remarked that he was rather disappointed with the report. It seemed to him that there was an entire absence of energy in the Company. It would be well if the Board appointed a competent man to move about in the interests of the Company, and try and push the business. The Chairman said they certainly had not done so much business as they could have wished; but this had not been for want of energy. They were as anxious to do business as the shareholders possibly could be. None of the Directors, he remarked, had yet obtained anything directly or indirectly from the Company. He had no fear about their success; but they could not get into a great business all at once. The report was adopted.

CHRISTMAS TIME AT THE YORK GAS-WORKS.

Mr. Sellers's Address to the Workmen.

Last Saturday, Mr. Charles Sellers, the Secretary and Manager of the York Gas Company, gave his usual Christmas address to the men employed on the works. He said:

We are again on the eve of another anniversary; and again I desire, for the sake of Auld Lang Syne, to wish you and your families a Merry Christmas and a Happy New Year. I say Auld Lang Syne because when I look back through the many long years of my associations with you, I can see among you to-day many men who have grown grey in the Company's service, and who, by their honourable conduct, have grown very much in my esteem. And it is this comforting reflection, this mutual confidence, that we can all meet together once a year, and loyally shake hands with each other and with our employers, which encourages me to keep up this little annual gathering, and to scatter bits of sunshine at your firesides for the pleasure and benefit of your children. The year just closing has not been an eventful year in startling discoveries either in the gas industry or in those industries which more or less compete with gas. But, perhaps, if there has been one feature in the lighting world more prominent than another, it has been something like the dying cry of Gœthe, the German philosopher—a demand for "more light." In every town, it is the same. Lighting companies are more severely criticized; and the responsibilities of those entrusted to provide light, whether gas or electric, are daily becoming more and more exacting. Unlike men engaged in many other occupations, we are expected to please everybody—a task which, perhaps, we might more nearly accomplish if we could control the weather. But as this is beyond our efforts, as it is beyond the efforts of all other men whose work is affected by it, we are often, from misapprehension, more sinned against than sinning. And I am not surprised at this. Our work meets the eye in every house and in every street; and as the present is an age of criticism, we need not be surprised if we get a very full share of that particular kind of attention. It behoves us, therefore, to pull together, and to do our best to deserve public confidence; remembering always that all our competitors live in very thin glass houses, and cannot afford even to throw a pebble at us. However, I will not pursue this subject. It is Christmas; and, for a moment or two, I will dispense with "shop," and deal only with social subjects. At the same time, I feel that fresh social texts are getting scarcer every year; for I have already addressed you on nearly all subjects which come within the practical duties and moralities of daily life. I have scattered seed upon these subjects broadcast; and although I have the pleasure to know that some has fallen upon good ground, I know and you know, that some has fallen upon ground that has been extremely flinty. But my experience has taught me the folly of expecting too much, and the wisdom of sympathy with human weakness:

"Be to our virtues very kind;
Be to our faults a little blind."

I have addressed you upon thrift and its many advantages, and upon sobriety, and its miserable contrast of intemperance with its rags and its wretchedness. I have also addressed you upon education, and upon home and family matters, in a way that only a bachelor can, but still in a way

"To make a happy fireside clime
To weans and wife;
For that's the true pathos and sublime
Of human life."

I have endeavoured to show you that if a man wants to grow grapes he must not sow thistles; and if he wants to grow a small banking account, and prepare for a rainy day, he must not plant his earnings in a gin-bottle. But here again my experience has brought me to acknowledge that there is a great deal of truth in Artemus Ward's observation, that it is useless to lift a man up who is rising, and it is a waste of time to lift another man up who is falling; for the first man will get up without your lifting, while the second man will tumble the moment you stop lifting. In other words, that there is no such thing as luck, and that every man must be the architect of his own fortune, and, like all good architects, he must not expect to build a life's success upon a bad foundation. And, lastly, let me beg, with all the earnestness of my soul, that no man's Christmas conduct will cast the slightest shadow upon the reputation of our old staff, by overstepping the bounds of sobriety, and making a Christmas ass of himself. I shall now have the pleasure of distributing amongst you the usual Christmas gifts for your children, and of informing you that our Directors have generously contributed towards their purchase. And let me further tell you that the Directors feel as great an interest in your social and family welfare as I do myself; and in this respect they deserve that old-fashioned loyalty which has always been the characteristic of the staff of the York United Gaslight Company. I have also pleasure in telling you that my mother, whose social heart, as some of you know, beats with yours, has contributed ten Christmas cakes—for, in the first place, motherless children, and, in the second place, for those of you who can "swagger," as some of you can, in having the largest number of children.

Mr. Sellers then distributed a large number of gifts—ranging from children's dresses to books and toys—to all the workmen who had children; after which three hearty cheers were given to the Directors and to Mrs. Sellers, and the men went home highly pleased with the presents.

THE ELECTRIC LIGHTING SCHEME FOR THE CITY OF LONDON.

Letting of the Western District to the Brush Company.

At the Meeting of the Commissioners of Sewers of the City of London last Tuesday—Mr. GREEN in the chair—the subject of the electric lighting of the City was again under discussion, on the presentation of a report by the Streets Committee relative to the tenders for lighting the western district.

Mr. CLOUDSLEY moved the adoption of the report, in the course of which the Committee recommended that the proposal of the Brush Electrical Engineering Company should be accepted, on similar terms to those contained in the agreement for the central district. They also recommended that the application of the Company for the consent of the Commissioners to their application to the Board of Trade for a Provisional Order should be granted, subject to a contract being executed as in the case of the central district. The Committee stated that the arrangements for the lighting of the western district were on similar terms to those settled for the east and central districts. In response to an advertisement, tenders had been received from the Brush Company and the Electric Installation and Maintenance Company. These had been referred to the officers, who reported that the tender of the former Company was on similar terms to those contained in the agreement entered into with them in respect to the central district, except that the power of the glow lamps was not specified. The Company had given notice of their intention to apply to Parliament for an Order in respect to this district similar in terms to that granted last year, except that only four streets were proposed to be provided with mains, instead of eighteen streets mentioned in the original specification, and the Company to be allowed two years instead of 21 months to lay the mains. The other Company in their tender accepted generally the conditions of the contracts; but it appeared that they were not able, with their own resources alone, to carry out the work of publicly lighting the district. They had, however, entered into a provisional contract with the Electric Construction Corporation for the whole of the works. They had not given notice of their intention to apply for a Provisional Order this session. The Committee had very carefully considered the tenders; and they unanimously recommended that that of the Brush Company should be accepted, and that assent should be given to their application to the Board of Trade. The Committee had also had under consideration the application of the Company for Blackfriars Bridge to be included in their area of supply, with a view to laying their mains from their proposed central station to the subway in Queen Victoria Street; and they recommended that the Company should be referred to the Bridge House Estates Committee, and that a letter should be addressed to that Committee in support of the application. Mr. Cloudsley said that the Committee had spent a very long time in discussing the tenders; and they had been assisted by Mr. W. H. Preece, on whose advice they unanimously came to the conclusion that the tender of the Brush Company was the one which should be accepted.

Mr. MORTON said he should like to ask when any portion of the City would be lighted by electricity.

The SOLICITOR said the contractors had commenced work in the main thoroughfares, and these would be completed within nine months from the date of the contract—May 19.

Mr. C. T. HARRIS said he would not go into details, but he must say that he, as a member of the Commissioners, would never consent to a contract which undertook to give a monopoly in private lighting for a period of 21 years, or, indeed, for any period. As matters stood at present, the Commissioners of Sewers, as the local authority, must oppose any other company who wished to seek for powers in parts of the City. He reminded the Court that the alternating supply was useless for motive power; and to manufacturers in the City, this in the future would probably be absolutely necessary. In the district with which he was familiar—namely, Victoria Street, Westminster—there were two electrical companies working, and consumers had the choice; and the direct-supply system was preferred because it would supply motive power. He believed that in years to come the Commissioners would be placed in an unfortunate position with the consumers in respect to their present action.

Mr. PANNELL remarked that the points raised by the previous speaker had been disposed of years ago.

The report was unanimously agreed to; and it was subsequently decided to send the Brush Company's letter respecting Blackfriars Bridge to the Town Clerk instead of to the Committee proposed.

CHELSEA WATER-WORKS COMPANY.

The Half-Yearly General Meeting of this Company was held last Thursday, at the Offices, Commercial Road, Pimlico—Sir W. H. WYATT in the chair.

The SECRETARY (Mr. G. H. Gill) read the notice convening the meeting; and the reports of the Directors and Auditors were taken as read.

The GOVERNOR said he hoped the shareholders would consider the report as satisfactory. This half year the expenses were down to about 29 per cent. of the gross income, which was lower than they had ever reached before; and he thought this was very gratifying considering the heavy amount they had paid for coal. He did not know that there was any water company which could show a better result than this, as regarded working expenses. The quantity of water pumped had increased considerably, partly owing to the new supplies and partly to the large quantity they were now furnishing to public establishments and business premises by meter. Their works were certified by both their Chief Engineer and District Engineers to be in first-rate order; and they hoped nothing very much would be required to be done for some time to come. They had not spent a great deal on capital account, except for new pipes and extensions, and to enlarge the coal-store at the Surbiton works, where they could now keep 1400 instead of 700 tons. This was an important consideration, in view of strikes, or of ice on the river. As the proprietors were aware, there had been an inquiry by the City Corporation into the water question. The Company were asked to attend and give evidence before the Committee. They replied that they could not, as they did not see that the Corporation had any power to hold such an inquiry. As the result of the investigation, an extraordinary Bill had been introduced into Parliament, in which the promoters asked for the appointment of a Trust of some kind or another. The only thing they sough positive power to do was that they might regulate the weight of consumers' fittings. It seemed a curious arrangement; but as they had no money whatever, he did not know how they were going to do anything. The County Council had also approached them, and had asked the Company to treat with them. They told the Council they had no power—that they could not treat with them; but if they cared to make a definite offer to them, the Directors would consider it, if it were a reasonable one. It would not answer a prosperous Company like theirs to sell their undertaking unless they were obliged to do so. They had now an excellent dividend, with a prospect of better things before them. It was said that it would be a very great advantage if the undertakings of the Companies were transferred to a public body. But everyone knew, if that step were taken, the consumers would pay more for their water in some shape or another—perhaps not for the water itself, but their rates would be increased; and he was sure the public would not get the same personal attention and civility which they now received from the Companies. He thought it was quite possible, however, in years to come—though the time was not very near—that some public body would be created to which they would have to transfer their undertaking. The inquiry into the water supply which the County Council were asking for, was a demand to which he did not know whether the Government would accede. It would cost all the Companies an immense deal of trouble and time, and a considerable expenditure of money; but he felt sure they would come out of the inquiry well, both as to the quality of the water they supplied and the quantity. He did not fear the result at all, and he thought he might prophecy that nothing would be done this session. If their concern were bought up, he did not feel doubtful about being reasonably recompensed. The rates and taxes continued to go up fearfully; and he did not think there was much hope for a reduction so far as the Company were concerned. It really came to this—that out of every sovereign they collected, about 1s. 9d. or 2s. went to the parishes for rates. They had settled the re-assessments of their property amicably with all the parishes, except two, where the demands were so exorbitant that they could not agree to them. They had overspent their capital account by £10,521; and they therefore thought it would be convenient now to raise the balance of the convertible 4½ per cent. preference stock; and the letters would be issued in the course of the day. The amount to be issued was only £16,205; so that the proportion which the proprietors received would not be a large amount. He hoped that, after the 31st of March next, they would be able to make their coal contracts on more favourable terms. The point which he supposed would be considered most satisfactory was the dividend; and this half year they were enabled out of reserve for that purpose to pay the full statutory dividend at the rate of 10 per cent. per annum. They had never been able to do this before. When he joined the Board in the year 1872, their dividend was 6 per cent. and many of the Directors, who were his seniors, would remember when they did not pay anything like 6 per cent. In 1872, their stock stood at 116; and now it was about 260. Of course, the diminished value of money had had something to do with this; but still they stood in a very satisfactory position. Now that they paid their maximum dividend, they would begin to think of the payment of back dividends. They could begin this process now if they appropriated the income which had been put by from time to time; but he was sure they would not wish anything done that was not expedient and safe. Therefore, he hoped they would not touch their reserves for anything of that kind. They were in a splendid position—in a position for receiving a reasonably secure 10 per cent., and they had also something to look forward to in connection with the dividends in arrear. As this was the first time they had paid their full dividend, they had considered it right to mark the event by granting a special gratuity to each member of their staff who had been in their service for not less than a year. He concluded by moving the adoption of the report.

The DEPUTY-GOVERNOR (Mr. F. S. Clayton) seconded the motion, which was carried unanimously.

The dividends recommended were then declared; and a vote of thanks to the Governor and Directors closed the proceedings.

The Finances of the Stockton and Middlesbrough Water Board.—The income of the Stockton and Middlesbrough Water Board for the year ending Nov. 23 last was £64,542; an increase of £4000 on 1889.

NOTES FROM SCOTLAND.

From our Edinburgh Correspondent.

EDINBURGH, *Saturday.*

At a special meeting on Monday last, the Edinburgh Town Council sanctioned the application to Parliament for extended powers under a new Police Bill, one of the provisions of which is that the Corporation are to light and extinguish the lights in common stairs. The Council are to supply the gas, or other light, and to light and extinguish the lights; and they propose to recover the cost of the gas, lighting, &c., from the occupiers of the houses, and of the fittings from the proprietors. It was proposed that, where houses are rented below £10, the whole cost should be borne by the proprietors, which, after a rather hot discussion, was carried by 28 votes to 10. In the opinion of the majority, it will be easier to collect the rate from the proprietor than the tenant in houses of a low rental. The Council also approved of application being made to Parliament for a Provisional Order, empowering the Corporation to supply electricity for lighting and other purposes. This was agreed to without a dissentient voice. The Provisional Order is no doubt drawn on lines similar to all others. It proposes that the price shall be 13s. 4d. for any quantity of electricity up to 20 units, and beyond that 8d. per unit—that is, put in other language, that the price shall be 8d. per unit, but that 20 units is the minimum quantity that will be charged for. Just imagine such a provision in the case of gas. What would people say were a gas company to announce that the price of gas was to be 3s. 9d. per 1000 cubic feet, but that 20,000 cubic feet would be charged for whether or not it were consumed. Such an arrangement, if it were tolerated, would quadruple the gas consumption in Edinburgh and Leith, because if people required to pay for so much gas, they would burn it; and the Commissioners would make a magnificent profit. Viewed in this light, the proposal is a well-conceived arrangement for promoting business, although it is also open to the serious disadvantage that it will prevent small consumers from adopting electric lighting. There is another reflection on the subject; and that is that a business which requires artificial bolstering of the sort indicated by this arrangement, cannot be expected to be a strong one. There is a proposal which the citizens of Edinburgh ought to see to, that any deficiency of income in any year shall be charged upon the local rate. A much more sensible proposal would be to make the deficiency fall upon the users of the electric light. It is true there is a gas contingent guarantee rate, to meet any deficiency in the income of the Gas Commissioners; but it is a very different thing from the proposal in this Order, because, so long as gas is being manufactured, the price of it can be regulated to suit the outlay of the Commissioners; and it is therefore only in security of the annuities that the power to impose a contingent rate exists. It is far otherwise, as the example of other towns has shown, with electric lighting; and if this matter were put before the citizens, they might have something to say in regard to it.

What is termed the Edinburgh "lamp globe mystery" is still engaging the attention of the Cleaning and Lighting Committee (*ante*, p. 1203). The other day a deputation of their members visited Messrs. Ford's glass-works in the city, from whence the globes are supplied, endeavouring to ascertain if any light could be thrown there upon the disappearance of over 1400 lamp globes; but they learned nothing. No satisfactory explanation of the disappearance of the globes has been obtained; but it is generally accepted as the most likely view, that there has been great laxity in the department charged with handing them out of the store. The incident is likely to lead to some re-arrangement of the department.

The quality of the gas supplied by the Falkirk Gas Company is the subject of a good deal of complaint in the district. Matters have, in fact, gone so far that the Town Council have been in communication on the subject with the Gas Company. The Lighting Committee of the Council met on Thursday night, and considered a reply by the Company, the terms of which they have not disclosed. After the meeting, they took a walk through the town, to satisfy themselves as to the lighting results from what they look upon as inferior gas. It is not known whether they discovered anything wrong with the light given by the lamps; but the extraordinary statement is made that they found a number of lamps out, and the gas turned on, and that they could not understand how this could happen, as there was no wind at the time. The Committee ordered an inquiry into the subject. What next will gas companies be blamed for?

The Directors of the Bo'ness Gas Company have agreed to pay the sum for which decree was given against them in the Court of Session on 19th ult., rather than run the risk of further outlay in the event of their losing in the House of Lords. In the interests of gas companies, this is to be regretted, because it allows the somewhat hasty conclusions of Lord Justice Clerk as to the laying of gas-pipes to be adopted as a principle of law; and it will be remembered that he laid down the rule that where pipes passed round a curve, no matter what system of joint was adopted, there should be packing with lead at the joints. This in itself may not be a great inconvenience or expense in the case of pipes to be laid in future. But the decision affects pipes already laid; and should there be an explosion arising from a leak in any of them, with a claim for damages following, the owners of the pipes will be obliged to pay. I understand that, if other gas-supplying bodies had agreed to assist in bearing the costs, an appeal would have been taken to the House of Lords; but I do not know that any effort was made to obtain such assistance.

The Watching and Lighting Committee of Aberdeen have begun an experiment in street lighting, in the shape of placing a 5-feet instead of a 2-feet burner in each alternate lamp and extinguishing the others. The Committee visited the streets in which the experiment is being tried on Wednesday night, and were of opinion that the change was no improvement; but they resolved to carry on the experiment for a time, in order to elicit the opinion of the public upon it.

From our Glasgow Correspondent.

GLASGOW, *Saturday.*

Considering the fact that there has been some more foggy weather this week over the area of the Glasgow Corporation gas supply, and

that there has been in addition, a further shortening of the days, it might well be expected that the demand for gas had again been very high. Still, the "record" consumption of yesterday week has not actually been broken. The deliveries during the 24-hour period ending at six o'clock this morning, amounted almost to those of yesterday week; being 20,209,000 cubic feet, as compared with 16,452,000 feet on the same day of last year. On Wednesday, the consumption was 19,164,000 feet, against 15,972,000 feet on Dec. 17, 1889; and on Thursday it rose to 19,418,000 feet, as compared with 16,522,000 feet on the corresponding day of last December. During part of this week, the number of retorts in actual use has risen to 1877.

The question of the non-lighting or inefficiency of the lighting of the common stairs, &c., in the town of Greenock has for some time back been engaging the attention of a Special Committee of the Police Board; and in regard to this matter a report from the Superintendent of Police to the Committee was under consideration at last Tuesday's meeting of the Police Commissioners. In moving the adoption of the minutes, Convener Mitchell said it would be observed that 42 house proprietors had failed to light their stairs in a proper way. If his motion was passed, the Board would be able to compel them to light the stairs. He also stated that of the 42 defaulters, two of them belonged to the Board! Those two, however, had since attended to the matter; and he hoped that the other 40 would follow suit. The motion was seconded; but in the course of the discussion which followed, several members deprecated the idea of departing from the usual custom, and eventually the whole subject was remitted to the Loan and Finance Committee for consideration and report.

Before leaving Greenock gas affairs, I may mention that the Manager of the Gas Department (Mr. S. Stewart) has again entered into wedlock. The employees of the Gas Trust on Thursday presented the bride with a beautiful solid silver tea service and tray of chaste design, through the collector (Mr. Chalmers) and Assistant-Manager (Mr. Mackie); and on the evening of that day about fifty of the employees and friends were entertained to dinner by Mr. Stewart. This gentleman, at a dinner privately held in Glasgow last week, was also the recipient of handsome presents for himself and his bride, from a number of the Scotch gas managers and other professional friends, whose admiration and respect for him extends over many years.

The Glasgow pig-iron market has been steady during the past week; and Scotch warrants, after being dealt in on Monday at 45s. 10d. per ton, advanced in price to 46s. 11½d., at which there were sellers at the close yesterday afternoon. In anticipation of the annual holidays, comparatively little business has been done; but the tone of the market is said to be distinctly steadier.

More business has been transacted in the coal market this week; and in one or two instances prices have increased slightly. With the advent of really wintry weather, there has been a marked increase in the demand for house coal, for which as much as 3d. per ton of advance has been obtained. Deliveries at various gas-works are very unsatisfactory, and much complaint is the result.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Dec.* 20.

Sulphate of Ammonia.—The market has been very quiet this week. Continental orders have been few. Frost and snow have interfered with the traffic to, and on the Continent; while the home demand, although giving signs of awakening, is as yet small. Nevertheless spot parcels have been moving off fairly well, owing to dealers' requirements; and a further decline has therefore been impeded. Very low quotations are floating about; but, judging the source they emanate from, they cannot be considered reliable, and are in opposition to the prices realized by makers. The quotations to-day are £10 13s. 9d., f.o.b. Hull; £11 12s. 6d., f.o.b. Leith; £10 15s., f.o.b. Liverpool. Some business has been done for American account, on the basis of about £10 15s., delivery up to March next.

LONDON, *Dec.* 20.

Tar Products.—This market keeps fairly active; and large sales have been made for the first six months of next year. Pitch also has recovered the ground it lost a week or two ago. Anthracene, on the other hand, is scarcely so good; and while there is little or no "A" offering, second-class anthracene is quoted 1d. per unit lower, with more sellers than buyers. Creosote and common oils continue in strong request. Carbolic acid is slow of sale. An important tar contract has been made on a basis of 29s. Business during the week has been noted at: Tar, 29s. Pitch, 35s. Benzol, 90 per cent., 4s. 7d.; 50 per cent., 3s. 6d. Toluol, 2s. Solvent naphtha, 1s. 9d. Crude naphtha, 1s. 8d. Creosote, 2¼d. Heavy oil, 3d. Crude carbolic, 60's, 1s. 6d. Cresol, 9d. Anthracene (30 per cent.), "A" quality, (nominal) 1s. 4d.; "B" quality, 1s.

Sulphate of Ammonia.—This article has again receded in value. The little spurt noted last week did not continue; and sales have been made during the week at prices ranging from £10 10s. to £10 12s. 6d. There are no important stocks, and it is to be deplored that makers lend themselves so easily to the machinations of "bear" operators. Ammoniacal liquor is quoted at 5s. 6d. to 7s., according to strength and position.

Private Bills in Parliament.—The time for depositing in the Private Bill Office of the House of Commons, copies of all Private Bills that are to be proceeded with during the present session, expired last Saturday. The total number deposited is 197, which is only four more than the number lodged in 1887, when the Bills were fewer than had been known for many years. Compared with last session, the decrease is 47. Of the total number deposited, 159 relate to England and Wales, 33 to Scotland, and 5 to Ireland. The list of notices given in the JOURNAL for the 2nd inst. comprised 46 Bills relating to gas and water. Of these only 40 have been deposited; three (those relating to Darwen, Fylde, and Leeds) being dropped, and three of the Bills relating to the Metropolis Water Supply being proceeded with as public measures. Last year the number of notices in our list was 47.

Wivenhoe Gas and Coal Company, Limited.—A Company under this title has been registered, with a capital of £2000, in £1 shares, to acquire the business of the Wivenhoe Gas Company, now in liquidation.

The Quality of the Water at Leeds.—The Borough Analyst of Leeds (Mr. T. Fairley) has recently examined samples of water from the various reservoirs from which the borough supply is drawn; and, as a result, it has been resolved by the Water Committee that the Eccup waters shall not be again used until the works now in progress at the reservoir there have been completed. It was found by Mr. Fairley that the water standing in this reservoir contained a larger proportion of living organisms than any of the other samples.

Lancashire Coal Trade.—The demand for most descriptions of fuel continues brisk; and there is a much firmer tone in the market than was lately the case. Gas coal of medium quality has been in request; and though in some directions an advance upon rates current at the beginning of the month is reported, prices rule about the same. Contracts, however, which have just been renewed have been at a slight advance upon previous prices; but not more than 6d. per ton. At the pit's mouth, best coal averages from 12s. to 12s. 6d. per ton; seconds, 10s. 6d. to 11s.; and commoner sorts, 9s. to 9s. 6d. There is plenty of coal of all kinds on the market; and this favours buyers of large stocks.

The Chairman of the Manchester Gas Committee.—The 80th birthday of Mr. Alderman J. Lamb was marked recently by the presentation to that gentleman of an illuminated address, bearing 130 signatures, by the officials and employees of the Manchester Gas Committee. Alderman Lamb has been for thirty years a member of the Committee; and during the last twelve years has occupied the office of Chairman. The Committee also passed a special resolution, expressing the members' high appreciation of Alderman Lamb's valuable services to the public during his long and honourable connection with the City Council. In reply, Alderman Lamb has written to the Gas Committee acknowledging the kindness and goodwill manifested towards him.

Bilston Gaslight Company.—The Directors of this Company have issued to the shareholders their report upon the working of the concern during the twelve months ending Sept. 30 last, a copy of which has been forwarded to us by the Secretary and Manager (Mr. J. S. Reeves). At profit and loss account there is a balance of £4606; and from this the Directors propose to pay dividends of 5s. and 3s. 6d. per share on the "A" and "B" shares respectively; making with the interim dividends 10s. and 7s. for the year. A balance of £2191 will remain to be carried to the next accounts. The revenue account shows that the profits of the year fall considerably short of the amount required for paying the usual dividends. While there has been during the year an increase of 3¼ per cent. in the sales of gas, and a substantial increase in the amount realized from coke, these advantages have been more than counterbalanced by the increased cost of coal and labour. The difference, however, would have been still more marked but for the favourable contracts for coal, which have now expired.

Leigh (Essex) Water Supply.—The formation of a Company for the purpose of supplying Leigh (Essex) and the surrounding district with water, for which purpose an application is to be made to the Board of Trade for a Provisional Order, is exciting considerable attention within the radius interested; and several Vestry meetings have been held within the past few days. It appears that the water supply was left to the Rural Sanitary Authority chiefly from a belief that, as Leigh would in time become a part of Southend, arrangements would be made with the Southend Water Company; and the chief complaint now made against the new Company is the unlikelihood of the Southend Company allowing a well to be bored at Rayleigh. This opposition it is feared may cause years of delay. That there is something in the contention of the opponents to the scheme is borne out by the fact that some years ago, when a scheme was brought forward to sink another well at Leigh, the Southend Company would not give the requisite permission; arguing that, if an improved water supply was needed, the existing wells might be improved, or the Company could be treated with to obtain powers for an extension of their area. The Rural Sanitary Authority was then approached, and £600 or £800 has been spent; but the water supply is still inadequate. This has undoubtedly caused the formation of the new Company, with a capital of £10,000; and it is stated that if the powers sought are obtained, it will be six years before the water can be supplied to Leigh. The position at the present time is that the Southend Company are to be asked if they will undertake the supply.

The Strike at the Darwen Gas-Works.—Since our report on this matter last week, we have learnt that a considerable number of the old hands have been taken back, on the distinct understanding that no interference, annoyance, insult, or molestation of the new hands must take place. This arrangement, however, on the part of the old hands has not been kept; and the Manager (Mr. T. Duxbury) has adopted means for insisting on its being adhered to. In the first place, he declines to take back any more old hands for a month, until the others prove that they can behave themselves. Secondly, he has given them notice that for every instance of interference or insult, two of the old hands must be discharged (the insulter and one of the ringleaders). On Thursday last the first case of insulting language, after the notice, occurred; and the offender, together with the Secretary of the Union, was at once dismissed. This created a sensation among the men; and Mr. P. Connor, of Manchester, was at once sent down to Darwen. An attempt to again bring out the men failed, as nine-tenths of those taken on declined to go out, and pointed to a letter received from the Union the previous week, refusing any more strike pay. Where any case of interference takes place, and the offender cannot be got at, the Manager has adopted a system of placing in a hat the names of all the returned men, and allowing one of them to draw; the name brought out being the man to be discharged. This is having its effect; and now the men are working peaceably, as they can see that both the Manager and the Town Council are determined, at all costs, to protect the new men, to whom work has been guaranteed for the winter. Scoops have been obtained, and they will be adopted in place of shovel charging if any more difficulty arises.

Union Intolerance.—As an illustration of the system of persecution of employers at present in vogue in the North by the Labour Unions, we give the following particulars: At a certain foundry the brass moulders took exception to the employment of one of the iron moulders, and represented to their employers that, unless this man was discharged forthwith, they would send in their notices. The iron moulders, on the contrary, stand by their fellow-workmen, and threaten to strike also if he is discharged. Thus the unfortunate firm find themselves between two fires from no fault of their own. As, however, the man in question is a steady and good workman, the managers decline to dismiss him without due cause. Thereupon the brass moulders work on the sympathies of the labourers and melters, and get them to tender their notices also. How it will end, cannot be foretold at present; but the course pursued is one that is not calculated to bring credit on the workmen's cause.

The Present Position of the Cardiff Water Supply.—An exhaustive report has recently been submitted to the Water Committee of the Cardiff County Council by the Water Engineer (Mr. J. A. B. Williams) on the present condition and the future prospects of the water supply of the borough. In it he shows that the quantity of water required per day, for a population of 147,000, is now 2,940,000 gallons; and he estimates that an additional million gallons will be needed in 1900 for a population of 197,000. The whole of the Taff Fawr works (save the storeage reservoirs Nos. 1 and 3) are completed and ready for use, with the exception of No. 2, or the Cantreff reservoir, which is under construction; and at least another year will be occupied in finishing it. When it is completed and filled, and the two storeage reservoirs at Llanishen and Lisvane are also filled with Taff Fawr water, amounting to 700 million gallons, the district, Mr. Williams says, can be supplied, by judicious management, with nearly 4 million gallons per day in a very dry year like 1887, after providing the statutory quantity of compensation water to be sent down the river, amounting to 2,979,000 gallons per twenty-four hours. He is of opinion that the commencement of No. 1 reservoir may safely be postponed until 1893, or the beginning of 1894; and, when it is constructed, the daily supply will be increased to about 5½ million gallons per day in a very dry year, and be sufficient for 275,000 persons.

Electric Lighting at Sea.—The diversity and unsatisfactory state of the rules relating to electric lighting have recently, says the *Electrician*, been discussed both in the daily and in the technical journals. It appears that another set has been put forward, which are to apply only to electric light on board ship. It is natural that regulations for this purpose should emanate from Lloyd's; and the prestige of this institution, coupled with the fact that they have for many years successfully exercised their authority in matters of engineering construction, will no doubt give to their electric light rules such an influential character that any propositions from other insurance offices will be unlikely to arise. The importance of having the very highest class of work on board ship cannot be over-estimated. Although the vessel be in mid-ocean, the conductors always have an "earth" near them. The ever-present damp, aggravated by the hygroscopic nature of sea salt, searches out leaks, and corrodes metal fittings. A fire on board ship, even of a limited character, is fraught with the greatest danger, though a similar outbreak on land might cause but a little unpleasantness. The difficulties of ship lighting are peculiar, and they are by no means fully apparent even to a contractor who has wired and fitted up half-a-dozen vessels. Nor can the sea-going officer, in whose hands the maintenance of the work is placed, be considered to have a complete knowledge of the whole of it. An interchange of experience between these two individuals is greatly to be desired. The Admiralty lighting is neither remarkable for economy nor for common sense, but the results are satisfactory; while the illumination of the ocean steamers is too often not only annoying, but dangerous, by reason of unsound and careless work.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 1232.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	10 Oct.	10½	Alliance & Dublin 10 p. c.	10	16—17	..	6 3 6
100,000	10	,,	7½	Do. 7 p. c.	10	12—13	..	5 15 6
300,000	100	1 July	5	Australian (Sydney) 5 % Deb.	100	107—109	..	4 11 9
100,000	20	27 Nov.	8	Bahia, Limited	20	17—19	..	8 8 5
200,000	5	13 Nov.	7½	Bombay, Limited	5	6¾—7¼	..	5 3 5
40,000	5	,,	7½	Do. New	4	5—5⅜	..	5 9 1
380,000	Stck.	14 Aug.	12½	Brentford Consolidated	100	212—217	..	5 12 11
125,000	,,	,,	9½	Do. New	100	155—160	..	5 15 7
220,000	20	11 Sept.	11½	Brighton & Hove Original	20	40—42	..	5 9 6
320,000	20	28 Mar.	11½	British.	20	43—45	..	5 0 0
50,000	10	11 Sept.	11	Bromley, Ordinary 10 p. c.	10	18—20	..	5 10 0
39,000	10	,,	8	Do. 7 p. c.	10	13—14	..	5 14 3
328,750	10	13 Nov.	6	Buenos Ayres (New) Limited	10	11—12	..	5 0 0
200,000	100	1 July	6	Do. 6 p. c. Deb.	100	103—106	..	5 13 2
150,000	20	14 Aug.	8	Cagliari, Limited	20	26—28	..	5 14 3
550,000	Stck.	10 Oct.	13⅜	Commercial, Old Stock	100	250—254	..	5 8 5
130,000	,,	,,	10⅝	Do. New do.	100	198—203	..	5 5 11
130,000	,,	27 June	4½	Do. 4½ p. c. Deb. do.	100	119—121	..	3 12 7
557,320	20	13 June	13	Continental Union, Limited	20	49—51	+1	5 1 11
242,680	20	,,	13	Do. New '69 & '72	14	33⅜—34⅜	..	5 5 3
200,000	20	,,	10	Do. 7 p. c. Perf.	20	39—41	..	1 17 7
75,000	Stck.	25 Sept.	10	Crystal Palace District	100	195—205	+5	4 17 7
234,060	10	16 July	—	European, Limited	10	19—20	..	—
120,000	10	,,	—	Do. New	10	19—20	..	—
354,060	10	,,	—	Do. do.	7½	13⅜—14⅜	..	—
5,470,620	Stck.	14 Aug.	13	Gaslight & Coke, A, Ordinary	100	235—240	+2½	5 8 4
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	98—101	..	3 19 3
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	247—252	..	3 19 4
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	100	119—123	..	4 1 3
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	177—182	..	4 2 5
1,300,000	,,	,,	7	Do. H, 7 p. c. max.	100	164—168	..	4 3 4
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	100	246—251	..	3 19 8
176,000	,,	—	—	Do. K, 6 p. c. Prf.	100	147—152	+4	3 19 0
1,061,150	,,	12 Dec.	4	Do. 4 p. c. Deb. Stk.	100	111—116*	..	3 9 0
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	121—126*	..	3 11 5
650,000	,,	,,	6	Do. 6 p. c. do.	100	158—162*	+1	3 14 1
3,800,000	Stck.	13 Nov.	12	Imperial Continental	100	220—225	−½	5 6 8
75,000	5	12 Dec.	6	Malta & Mediterranean, Ltd.	5	5—5⅛*	..	5 9 1
560,000	100	1 Oct.	5	Met. of Melbourne, 5 p. c. Deb.	100	109—111	..	4 10 1
541,920	20	27 Nov.	6⅔	Monte Video, Limited	20	18½—19½	..	6 13 4
150,000	5	27 Nov	10	Oriental, Limited	5	8¾—9¼	..	5 8 1
60,000	5	25 Sept.	7	Ottoman, Limited	5	5—5⅛	..	6 7 3
166,870	10	16 July	4	Pará Limited	10	3—4	..	10 0 0
420,000	100	3 Nov.	6	People's Gas of Chicago— 1st Mtg. Bds.	100	95—100	..	6 0 0
500,000	100	1 Dec.	16	2nd Do.	100	93—98	..	6 2 5
150,000	10	10 Oct.	10	San Paulo, Limited	10	16—17	..	5 17 8
500,000	Stck.	28 Aug.	13⅓	South Metropolitan, A Stock	100	280—285	−3	4 12 11
1,350,000	,,	,,	11⅓	Do. B do.	100	228—233	+2	4 18 9
141,500	,,	,,	2	Do. C do.	100	235—245	..	4 17 11
650,000	,,	27 June	5	Do. 5 p. c. Deb. Stk.	100	142—147	..	3 8 0
60,000	5	11 Sept.	11½	Tottenham & Edm'nton, Orig.	5	11—13	..	4 8 5
				WATER COMPANIES.				
729,221	Stck.	13 June	10†	Chelsea, Ordinary	100	274—279	+1	3 11 8
1,720,560	Stck.	10 Oct.	7½	East London, Ordinary	100	213—218	+1	3 8 10
541,440	,,	27 June	4⅓	Do. 4½ p. c. Deb. Stk.	100	142—147	..	3 1 2
700,000	50	12 Dec.	9	Grand Junction	50	117—122*	..	3 13 9
708,000	Stck.	14 Aug.	10½	Kent	100	273—278	+2	3 15 6
1,043,800	100	27 June	9½	Lambeth, 10 p. c. max.	100	249—254	+1	3 14 9
406,200	100	,,	7½	Do. 7½ p. c. max.	100	198—203	+1	3 13 10
260,000	Stck.	25 Sept.	4	Do. 4 p. c. Deb. Stk.	100	120—124	..	3 4 6
500,000	100	14 Aug.	12½	New River, New Shares	100	360—365	..	3 6 5
1,000,000	Stck.	31 July	4	Do. 4 p. c. Deb. Stk	100	125—128	..	3 2 6
902,300	Stck.	12 Dec.	7	S'thwk & V'xhall, 10 p. c. max.	100	175—180*	..	3 17 9
126,500	100	,,	7	Do. 7½ p. c. do.	100	167—172*	..	4 1 4
1,155,066	Stck	12 Dec.	10	West Middlesex	100	260—265*	..	3 15 6

*Ex Div.

† Next dividend will be at this rate.

GWYNNE & BEALE'S PATENT GAS EXHAUSTERS AND ENGINES.

Telegrams: "GWYNNEGRAM LONDON." TELEPHONE No. 2698.

GWYNNE & CO.,

HYDRAULIC AND GAS ENGINEERS,

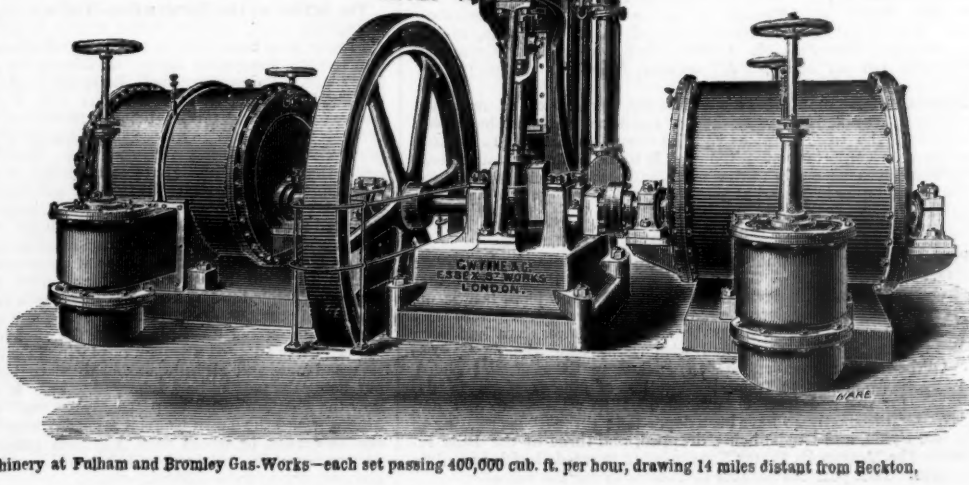
ESSEX STREET WORKS, VICTORIA EMBANKMENT, LONDON, W.C.

Thirty-three Medals at all the Great International Exhibitions have been awarded to GWYNNE & Co. for Gas Exhausters, &c.

They have completed Exhausters to the extent of 29,000,000 cubic feet passed per hour, which are giving unqualified satisfaction in work.

Makers of Gas-Valves, Hydraulic Regulators, Vacuum Governors, Steam-Pumps for Tar, Liquor, or Water; Centrifugal Pumps and Pumping Engines, specially adapted for Water-Works, raising Sewage, &c.

Also GIRARD and other TURBINES, HIGH-SPEED ENGINES, DYNAMOS, &c., &c., for ELECTRIC LIGHTING.



Their Exhausters can be made, when desired, on their New Patent Principle, to pass Gas without the slightest oscillation or variation in pressure.

Catalogues and Testimonials on application.

Exhausting Machinery at Fulham and Bromley Gas-Works—each set passing 400,000 cub. ft. per hour, drawing 14 miles distant from Beckton.

NOTICE TO ADVERTISERS.—COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office *not later* than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of PERMANENT ADVERTISEMENTS should be received not later than the FIRST POST on SATURDAYS.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale in the United Kingdom than all other Oxides combined. Purity and uniformity of quality guaranteed. Pamphlet, "How to Purchase Bog Ore," to be obtained on application.

Gas Purification and Chemical Company, Limited, Palmerston Buildings, Old Broad Street, London, E.C.
JOHN WM. O'NEILL, Managing Director.

CANNEL COAL, ETC.

JOHN ROMANS & SON, EDINBURGH. Gas Engineers, supply all the most approved SCOTTISH CANNELS; also FIRE-CLAY GOODS, CAST-IRON PIPES, and other APPARATUS for GAS AND WATER WORKS.

Prices, &c., will be forwarded on application to No. 80, ST. ANDREW SQUARE, EDINBURGH, / NEWTON GRANGE, NEAR DALKEITH, } SCOTLAND.

JOHN RILEY & SONS, Chemical Manufacturers, Hapton, near Accrington, are MAKERS of SULPHURIC ACID, from Brimstone, for Sulphate of Ammonia making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol. References given to Gas Companies.

SADLER AND CO., LIMITED, MIDDLESBROUGH; ULVERSTON (BARROW); PORTSMOUTH; CARLTON; STOCKTON; 85, Gracechurch Street, LONDON; 70, Wellington Street, GLASGOW; 10, Marsden Street, MANCHESTER; and 96, Reade Street, NEW YORK. Tar Distillers, Manufacturers of all TAR PRODUCTS, ALIZARINE and other TAR COLOURS, BICHROMES, OXALIC ACID, ALKALIES, LIQUOR AMMONIA, AMMONIA SULPHATE, &c.

Head Office: MIDDLESBROUGH. Correspondence invited.

EXTRACT from the Harrogate Gas Company's Report, dated the 5th of February, 1890: Coal consumed, 8600 tons. Gas made, 92,880,000 feet; ditto sold, 84,880,000 feet; ditto unaccounted for, 8,000,000 feet; quantity made per ton, 10,800 feet; ditto sold, 9869 feet. Illuminating Power, 16·1 candles. Coals used, Brancepeth. Owners, Strakers and Love, Newcastle-on-Tyne; who have also Brandon Hutton Seam Unscreened Gas Coal. Analysis, 10,500 cubic feet per ton; Illuminating Power, 16·2 candles.

COZE'S Automatic Apparatus for CHARGING AND DISCHARGING GAS-RETORTS. For Illustrated Advertisement of this System, see p. 1128.

Inquiries should be addressed to THE AUTOMATIC COAL-GAS COMPANY, LIMITED, 86-88A, LEADENHALL STREET, E.C.

TAR and Liquor wanted. BROTHERTON AND CO., Commercial Buildings, LEEDS.

£5 Bonus. Wanted, a permanent Situation as TIME-KEEPER, or any position of trust.

Address No. 1891, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Situation as Under MANAGER in Gas-Works. Four years' experience, and at present employed with one of the Leading Firms of Gas Engineers.

Apply, by letter, to No. 1886, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Traveller to sell Wet and Dry Meters in any part of the Kingdom.

Apply, by letter, to No. 1888, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Gas-Fitter for the Brierley Hill District Gaslight Company. Permanent employment to a good, steady workman. Wages, 5s. per day (58½ hours to the week).

Testimonials (not exceeding three), in applicant's own handwriting, to be sent to the SECRETARY, Gas-Works, BRIERLEY HILL.

COUNTY BOROUGH OF WIGAN.

WANTED, a Fitter for the Gas Department. One who has had experience in Main and Service Laying preferred.

Application, with references, to be made to the undersigned,

JOS. TIMMINS, Engineer.

Dec. 10, 1890.

RAWMARSH LOCAL BOARD.

WANTED A PLUMBER & GAS-FITTER.

THE Rawmarsh Local Board require the services of a PLUMBER and GAS-FITTER. Must be competent to lay Gas and Water Mains, fix Hydrants, Fire-Cocks, Sluices, Gas-Meters, Fittings, and Services, read Water and Gas Meters, and attend to General Repairs of Lamps, &c.

Apply, by letter, enclosing copies of three recent testimonials, as to competency and character, to me, the undersigned, on or before Tuesday, the 6th of January, 1891.

Wages, 32s. per week (no overtime).

By order,
J. W. BELLAMY, Clerk and Surveyor.

Rawmarsh Local Board Office, Dec. 19, 1890.

JAMES LAWRIE & CO. supply Best SCOTCH CANNEL COALS, Best FIRE-CLAY RETORTS, BRICKS, TILES, and LUMPS; BOILER SEATING BLOCKS, FLUE COVERS, and SILICA BRICKS for SPECIAL FURNACE WORK; COKE BARROWS, BOGIES, and SMALL WAGONS.

Postal Address: 1, WHITTINGTON AVENUE, E.C.
Telegram Address: "EIRWAL LONDON."

W. C. HOLMES & Co., Huddersfield, AND 80, CANNON STREET, LONDON,

Contractors for Gas-Works complete, Makers of Gasholders, Purifiers, Scrubbers, Condensers, Retort Fittings, &c., Improved Valves, Engines, and Exhausters. Also for Collingwood's Regenerative Retort-Settings.

*** See Advertisement p. 1261 of last week's issue.

Cablegrams: "Ignitor London." Telegrams: "Holmes Huddersfield."

J. & J. BRADDOCK, Globe Meter Works, Oldham.

First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.

Telegraphic Address: "Braddock, Oldham."

SULPHURIC ACID, B.O.V., for Sulphate of Ammonia Making. Guaranteed clear, of full strength, and to produce a fine white-coloured salt, Delivered in carboys or railway tank waggons.

For prices and terms address BALE, BAKER, AND CO., 120 & 121, Newgate Street, LONDON.

WANTED, a Stoker for a small Gas-Works in Dorsetshire. Wages, £1 per week.

Applications, with reference, to be forwarded to No. 1892, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a small Gasholder 9 feet to 12 feet diameter.

Send particulars to J. HARDMAN, AND CO., Tunstall, STOKE-ON-TRENT.

WANTED, to purchase the Fittings (Iron work) complete for Two or Four Settings of seven Retorts.

Address, with full particulars, the SECRETARY, Gas-Works, Wetherby, YORKS.

WANTED, to purchase Gas Carbon delivered at nearest Station to Gas-Works, in quantities of not less than 4 tons.

Address, stating price per ton and quantity, No. 1766, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a second-hand Beale or other EXHAUSTER, in good condition, to pass about 20,000 cubic feet of Gas per hour.

Address, stating particulars and price, No. 1869, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

FOR SALE—Gas Plant complete. Gas-holder, 30 ft. by 10 ft.; Two Purifiers, 6 ft. by 3 ft. 6 in.; Retort-House Fittings, Condenser, Washer, Governor, Station Meter, and 4-inch Connections.

Apply to GEO. E. WOODFORD, RUABON.

FOR SALE—Seven Purifiers, 15 feet square, with Sieves, Connections, Valves, and Lifting Apparatus complete.

One PURIFIER, 20 ft. by 16 ft., with Sieves, Connections, Valves, and Lifting Apparatus complete.
Two Wrought-Iron TANKS, 8 feet diameter by 7 feet and 6 feet respectively.
One REID'S GAS WASHER.
Two Cast-Iron TANKS, 15 ft. 8 in. diameter by 11 ft. 4 in. and 8 ft. 6 in. respectively.
Two EXHAUSTERS (Jones), equal to 25,000 cubic feet per hour.
A number of 15-inch and other VALVES.
A quantity of SHAFTING and PULLEYS.

J. HEPWORTH.

Gas-Works, Carlisle, Nov. 14, 1890.

THE Directors of the Sheffield United Gaslight Company invite TENDERS for the construction and erection of two PURIFIERS, each 34 feet by 19 feet, with Covers, and for the supply of the Girders, Columns, &c., to carry the same, for their Effingham Street Station.

Forms of tender, with bills of quantities may be obtained, and drawings may be seen, on and after Friday, the 12th inst., on application to the Company's Engineer, Mr. Fletcher W. Stevenson.

The Directors do not bind themselves to accept the lowest or any tender.

Sealed tenders to be sent in to the undersigned not later than Tuesday, Jan. 6, 1891, endorsed "Tender for Purifiers."

HANBURY THOMAS, General Manager.

Commercial Street, Sheffield, Dec. 6, 1890.

FOR DISTRIBUTION WITH GAS ACCOUNTS.

A 4pp. Leaflet, entitled "The Use of GAS-STOVES IN OUR HOMES;" being a reprint of an article from the *Home Provider*. Price 3s. 6d. per 100. Special quotations for larger quantities, and, if required, for printing Gas Company's own announcement on first or last page. Specimen copy, free by post, 1½d.

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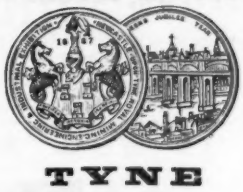

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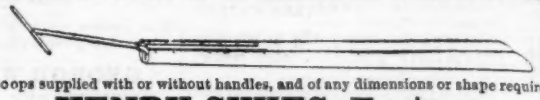

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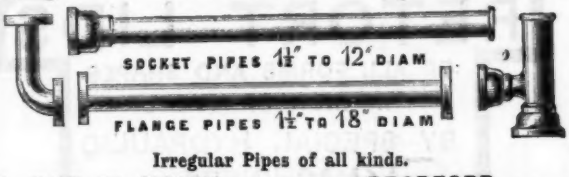

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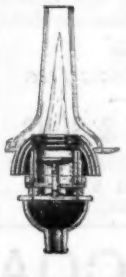

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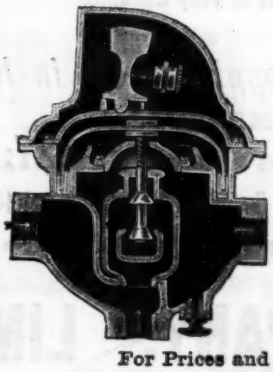
As supplied to and approved of by H.M. Government.

The most reliable Automatic Method of economizing Gas without reducing the Illuminating Power.



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FLOOR WARMING STOVES

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THESE STOVES ARE

CLEANLY, PORTABLE, ECONOMICAL,

And applicable for all kinds of Rooms where a Comfortable and Wholesome Atmosphere is desired.

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BELL'S ASBESTOS AQUOL PAINT

IS MADE READY FOR USE.

IS FIRE RESISTING.
IS WASHABLE.
IS NON-POISONOUS.
IS MANUFACTURED IN ALL USEFUL COLOURS.
IS IMPERVIOUS TO HEAT, COLD, OR WATER.
IS WITHOUT SMELL.

No expensive Oil or Turpentine required.

WILL NEVER BLISTER.

HAS A COVERING CAPACITY **40** PER CENT. GREATER THAN LEAD PAINTS.

For Outside or Inside Work in any Climate.

Bell's Asbestos Aquol Paint is equally suitable for the finest decorative work as well as for general painting. It can be applied over or under any other paint, and, owing to its easy application, can be used with a large distemper brush; the SAVING THUS EFFECTED IN LABOUR BEING **50** PER CENT. OVER THAT OF LEAD PAINTS.

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Those who Study Economy and Protection from Fire should use only

BELL'S ASBESTOS AQUOL PAINT.

BELL'S ASBESTOS AQUOL PRIMING is made Ready for Use.
BELL'S ASBESTOS AQUOL PRIMING stops all suction of Wood, Cement, Plaster, &c.
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BELL'S ASBESTOS DAGGER PACKING

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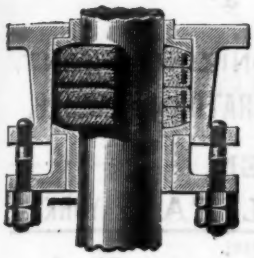
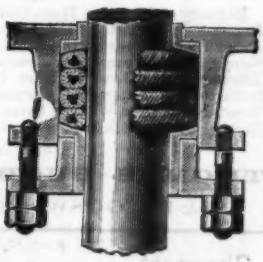


ROUND



SQUARE. Every 10 feet has Label as above, and bears our Trade Mark.

Under this registered title are included the inventions of Mr. Field; and experience has proved them to be the MOST EFFICIENT DURABLE, and ECONOMICAL PACKINGS ever made. They constitute such a combination of Asbestos and India-rubber as secures the maximum of elasticity and heat resistance; and they are, therefore, UNEQUALLED FOR EVERY KIND OF ENGINE. These Packings are being universally used by most of the leading Steamship Companies throughout the world for ordinary Compound, Triple, and Quadruple Expansion Engines of the latest types. The packings are composed of rolled Asbestos Cloth, but the India-rubber is placed in two forms to suit various cases

IN ORDERING STATE WHETHER SQUARE OR ROUND IS REQUIRED.

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BELL'S
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Is specially suited for
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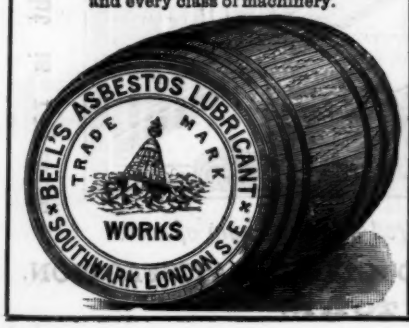
BELL'S ASBESTOS LUBRICANT
Is unequalled
For Steam-Engines & Cylinders, Gas-Engines, and every class of machinery.



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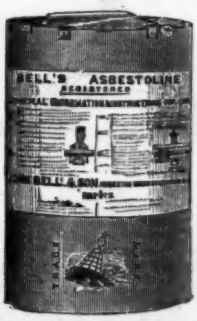
The reputation of this Lubricant is based on the experience of thousands of users, which places it far in advance of those who rely only on mere laboratory tests.

ASBESTOLINE IS THE CHEAPEST MOST EFFICIENT, CLEANEST MOST INODOROUS AND SAFEST LUBRICANT.



ASBESTOLINE HAS SAVED 90 PER CENT. OVER OIL. Has been used for all purposes, AND BEATEN ALL OTHER LUBRICANTS IN ACTUAL WORK.

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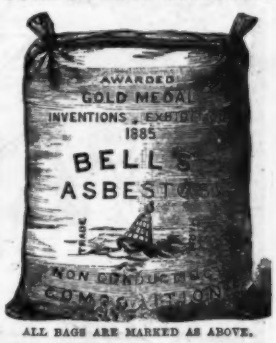
RINGS, AND TAPE.
Is the most efficient and reliable Material for Manhole, Mudhole, Steam-Pipe, and all other Joints.

BELL'S ASBESTOS
NON-CONDUCTING COMPOSITION.
Will reduce loss by radiation and saves 40 per cent. of fuel.
Is superior to any other, and saves its cost in a few months.



Can be applied again after many years' service. Is sent out dry in bags; therefore cheaper than others sent wet.

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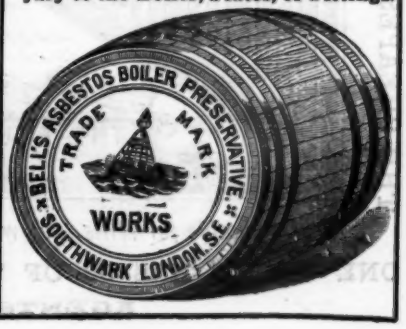
Will effectually keep Boilers clean, and remove any Incrustation, without injury to the Boiler, Plates, or Fittings.



Gas-Bags for Mains. High-Water Boots. Woollen Miners' Jackets.

Delivery and Suction Hose, Gutta-Percha Acid Bottles, Leather Driving Bands, Woven Canvas Hose for Fire-Engines, Wedge and Square Gas-Bags, Air and Water Beds for Invalids, Oil Tarpauling Coats, Trousers, Hats, &c., Squeegees for cleansing Pavements, &c., Billiard and Bagatelle Cush, Tricycle Tyres, Leather Hose, Cotton Waste, Engine Cloths, Oils, &c., India-rubber Waterproof Garments for Walking, Driving, or Sporting Wear, Diving and Wading Dresses, Printers' Blankets, Iron Wheels and Rollers covered with India-rubber, and Stokers' Gloves.

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THE POPULAR.

Cheapest and Best in the Market.

No. 5 burns 5 to 7 ft. of Gas per hour; and No. 10, 10 to 12 ft.

Priced complete with Governor, Bye-pass Tap, &c.

Iron-decorative Body with Enamelled Tube and Consumer.
No. 5 45s. each,
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LAMP MANUFACTURING COMPY., LIMITED.

Sole Licensees of

THE FULLFORD GAS-LAMP

(PATENT).

The flame of the Fullford Lamp when first lighted goes immediately into action without any explosion; and after a few minutes, burns with great steadiness and brilliancy.

AGENTS WANTED EVERYWHERE.
LARGE DISCOUNT. LIBERAL TERMS.

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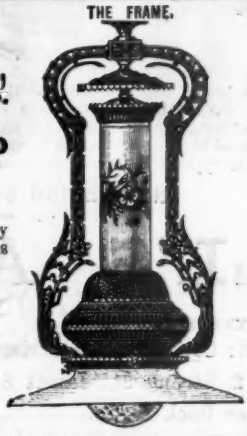

Simple, Economical, Reliable,

Easy to light as an ordinary Flat-Flame Gas-Burner.

Save your Gas and your Eyes.

Electro-bronzed Body and Frame with painted Enamelled Tube. Very elegant.
No. 5 85s. each.
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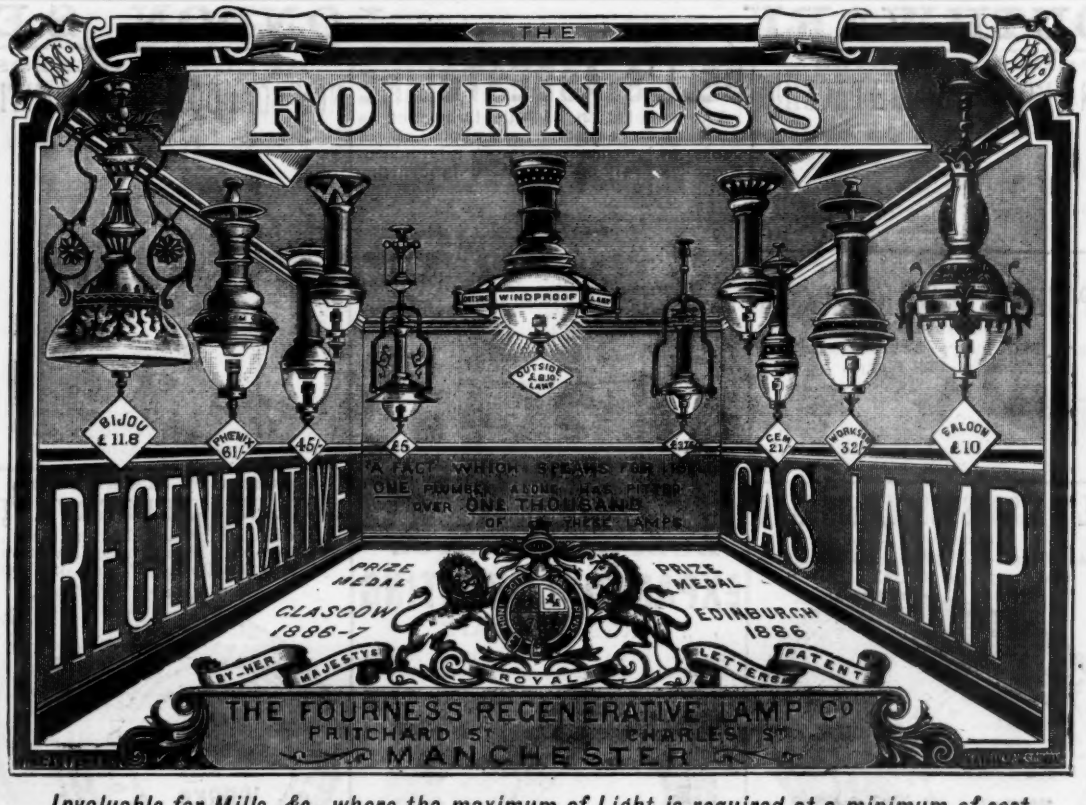
THE CHEAPEST AND BEST LAMP IN THE MARKET.



Suitable for every place where Gaslight is required.

Invaluable for Mills, &c., where the maximum of Light is required at a minimum of cost.

ONE WORKS HAS 96 OF THESE LAMPS FIXED AND GIVING SATISFACTION.

AGENTS WANTED IN EVERY TOWN.

GAS COAL.

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REAL OLD SILKSTONE GAS COAL.
Address, THE STRAFFORD COLLIERIES COMPANY,
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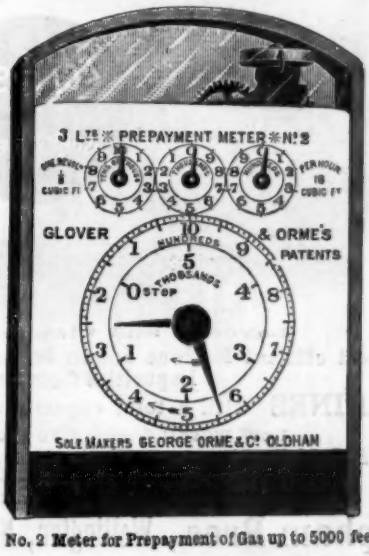

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We shall be pleased to send PRICES and full description upon application; also Particulars of the Regulations and Terms adopted where the System is in use.

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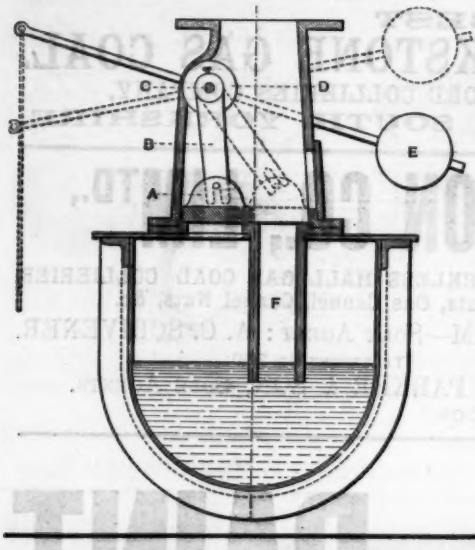

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IMPROVED SLIDE-VALVE ANTI-DIP

Is perfectly reliable in action, and requires no attention.
Has all the advantages of the Dip and Anti-Dip combined.
Is cheap, and easily fixed to any form of main.
Will save more than their cost in one season's working.

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Further particulars from the Sole Patentee and Manufacturer,

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THE BRITISH WATER GAS SYNDICATE, LTD.,

Is prepared to give Estimates for, and undertake the erection of,

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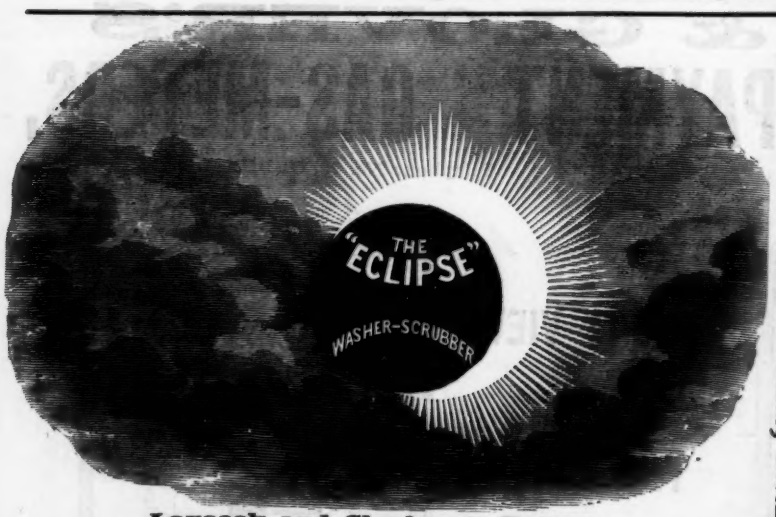

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MACHINES with a total capacity of **42,500,000** cubic feet now working, and give great satisfaction.

LAST YEAR 11 Machines erected with a total capacity of **20,000,000** *feet.*

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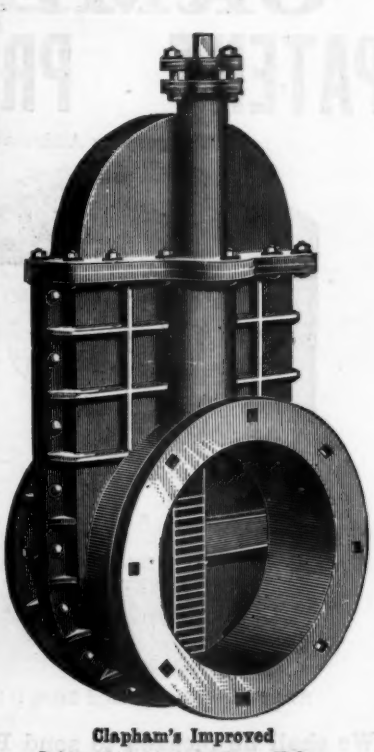
Mr. E. H. Wardwell, 10, Warren Street, New York, U.S.

SILVER MEDAL, Inventions Exhibition, 1885.



Clapham's Improved Internal Rack and Worm Valve, Gas-Mains, &c.

London: Printed by WALTER KING (at the Office of King, Sell, and Railton, Ltd., 12, Gough Square); and published by him at No. 11, Bolt Court, Fleet Street, in the City of London.—Tuesday, Dec. 23, 1890.